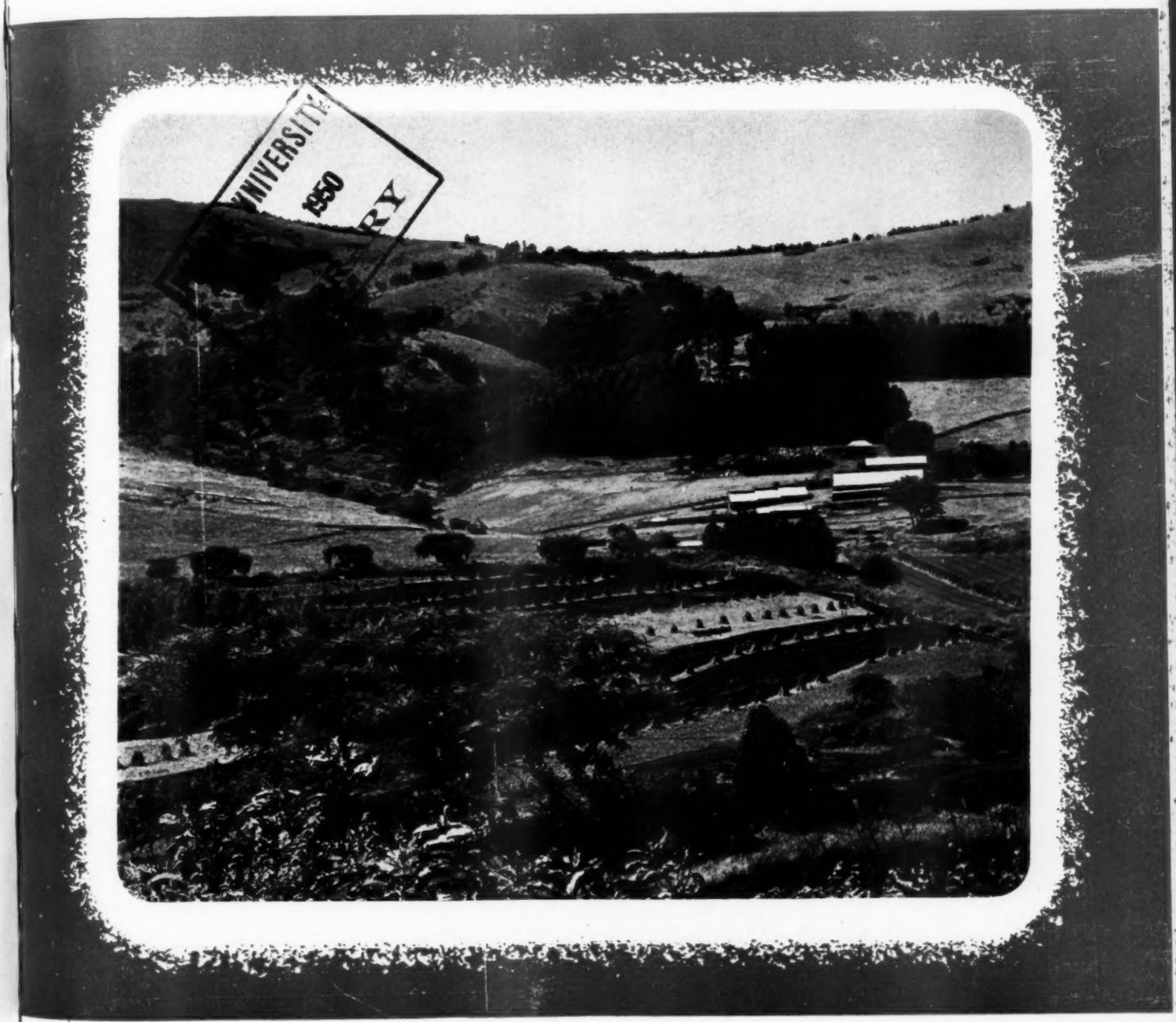
PURDUE UNIVERSITY
JUL 28 1950
LIBRARY

# WORLD CROPS

THEIR CULTIVATION, PROTECTION, STORAGE, HANDLING AND PROCESSING FOR FOOD, FODDER, AND INDUSTRIAL PRODUCTS




VOLUME 2, No. 6 JUNE 1950

A Publication of The Leonard Hill Technical Group

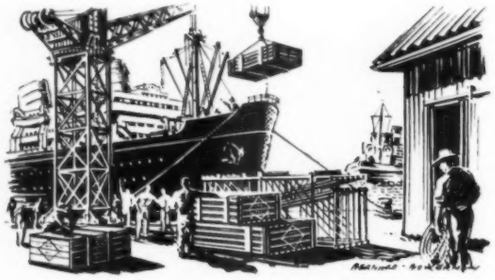
*THE*

# ARCON IDEA

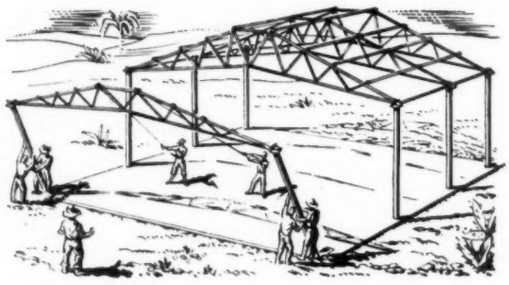
*FOR PERMANENT TROPICAL BUILDING*

## So Fast · So Easy · So Adaptable

*New Constructional Principle Effects Amazing Time Saving*



Arcon components are crated and packed for convenient, speedy transport. The weight of the crates is always kept down to a minimum that permits man-handling.



It takes a labour force of seven unskilled men approximately seven hours to erect an Arcon 3-Bay tropical building framework.

Because Arcon Roofing is fixed before the work on the walls and interior is begun, any time-wasting weather interference at a late stage is avoided.

With the framework and roof in place, the work of completion can be carried out in suitable local materials which are both inexpensive and readily available.

THE ARCON BUILDING has been designed with special emphasis on the three points of adaptability, ease and speed of erection by an unskilled labour force. Extra Bays, each adding another 10 ft. can be utilized to give any required length of building, and the roof can be supplied with columns to give heights of 9 ft. or 15 ft. to eaves. The complete Arcon Structure is robust, fireproof, termite-proof and practically indestructible. With the specially designed heat-insulating interior roofing, it provides a cool, strong building, ideal for service in the tropics and sub-tropics.

**IMMEDIATE DELIVERIES**
**Arcon structural components, in any quantity, are available for immediate shipment to you.**

*Write for fully descriptive brochure to:—*

**TAYLOR WOODROW (Building Exports) Ltd.**
41 WELBECK STREET · LONDON W1 · ENGLAND

ARCON STRUCTURES

# WORLD CROPS

Editor: Sir Harold A. Tempany, C.M.G., C.B.E., D.SC., F.R.I.C.


## CONTENTS


VOL. 2 No. 6 JUNE 1950



EDITORIAL COMMENT:
Dry Farming in the Tropics and Sub-Tropics; Problems of Tropical Africa and their Social Implications; Hill Grazing; Partial Sterilisation of the Soil; Spare the Bees; Agricultural Man-hours ... 231

Hill Country Grasslands—*E. Bruce Levy* ... 235

Crops Under Glass in the Lea Valley—*W. F. Bewley*, C.B.E., D.SC., V.M.H. ... 238

Fumigants for Insect Control in Stored Foodstuffs—*W. Burns Brown*, M.SC., F.R.I.C. ... 241

The Palm Oil Industry of Indonesia—*J. Grindrod*, B.A.(COM.) ... 245

World Grain Crops Reviewed ... 248

Cocoa Production in South America ... 249

The Problems of Selective Weed-killing ... 252

Crop Costing ... 254

Egyptian Agriculture ... 258

Dry Year for S. African Farms ... 261

Control of Citrus Pests in California ... 263

The Saltbushes of S. Australia ... 266

Mounted Implements on the Farm ... 268

Farm Machinery: N.Z. Tractor Market; Rubber Tyres on Ploughs Save Tractor Fuel; U.S. Farm Machinery Exports; Spray Manufacturers Combine; Implement Range; Survey of Middle East Markets; Small Grass Drier ... 270

Safety Precautions in Using DNOC and Parathion ... 272

New Books ... 273

Correspondence ... 274

World Crop Reports ... 275


### *THIS MONTH'S COVER*

***This beautiful view of a mixed farm in the Penhalonga district of Southern Rhodesia illustrates the manner in which the farming system can be adapted to the local surround. Note the protective belts of trees and other enclosures to minimise erosion risks.***

*(Photo: Public Relations Dept. of S. Rhodesia)*


**Price per copy 2s. 6d.** *Subscription rates on application*

LEONARD HILL LIMITED, 17 STRATFORD PLACE, LONDON W.1, ENGLAND (Mayfair 7383)

# THE 'AGROCIDES' PROTECT MOST OF YOUR CROPS AGAINST THEIR WORST ENEMIES

*The 'Agrocide' products are insecticidal dusts and sprays containing the powerful insecticide 'Gammexane' gamma BHC which is deadly to a wide range of insect pests in both horticulture and agriculture, but harmless to man and warm blooded animals. Growers can thus buy Agrocide products with complete confidence in their effectiveness and safety.*

WHERE a general purpose dust is required use Agrocide 3. This product controls beetles, weevils, aphids, frog-hoppers, thrips and other pests attacking vegetables, rice, cotton, sugarcane, oilpalm and other crops.

WHERE the use of a spray is preferred, Agrocide Wettable Powder provides an excellent means of applying 'Gammexane' gamma BHC in a dispersible form. It is ideal as a spray for outdoor crops, in particular orchard crops and strawberries, against thrips, leaf-miner, aphids, leaf-hoppers, capsid bugs, leaf beetles and weevils and caterpillars.

PLANT PROTECTION LTD. 61 CURZON STREET, LONDON W.1. ENGLAND
*or overseas agents*

# Editorial Comment

## *Dry farming in the tropics and sub-tropics*

WHETHER to weed or not to weed has always been something of a vexed question for the agriculturist. Nowhere has this been more in evidence than in the tropics and sub-tropics, for in different places weeding has at times produced apparently quite opposite results.

Thus on tea and rubber plantations in the high rainfall regions of the Far East clean weeding was formerly the invariable and inflexible rule, and it was only when it was found that it was leading to serious erosion and loss of fertility that weeding was replaced by cover cropping. Experience in the same areas has shown that when such lands are continuously weeded they may become quite unproductive unless their fertility is restored by liberal dressings of organic manure.

As against this, in low rainfall areas clean weeding is often beneficial, and, indeed, the bare fallowing of lands in the sub-humid and semi-arid areas of the Middle East is part of traditional practice from time immemorial. Work in the Sudan has shown that under the conditions in the Gezira the most satisfactory rotation is one which periodically includes a whole season during which the land is not cropped, but kept clean weeded under a bare fallow.

The key to the matter lies, of course, in the soil moisture. In low rainfall areas, if land is allowed to become covered with weed growth between crops, the amount of water removed from the soil by transpiration during the dry season may so completely dry out the soil as to deplete the reserves of moisture available for the growth of the ensuing crop. It was formerly believed that the maintenance of a loose surface layer of friable soil acted as a mulch and also reduced losses of soil moisture, but this idea has been largely superseded during recent years and the main factor is generally accepted to be the suppression of weed growth.

The matter, however, does not end here, for work in Uganda, the Sudan and elsewhere in the dry tropics has shown that under clean weeding considerable accumulations of nitrate occur in the top layers of soil and benefit the succeeding crop. The microbiological relationships are obviously of great importance, as is soil organic matter, on which microbiological activity largely depends. It may be that under dry conditions the decay of organic matter, as the result of microbiological activity, is arrested during dry periods, while in humid and sub-humid regions they proceed more or less continuously without any such check, and that this accounts for the difference in behaviour.

Moreover, while rotations embodying alternations of arable crops with grass leys for grazing are generally agreed to be suitable for areas with medium rainfall, they may not be suited to regions in which the rainfall is very low or, alternatively, to those in which rainfall is very high.

The solution of this intriguing question depends on acquiring more fundamental knowledge of the functions of organic matter in tropical soils and the related microbiological activities on the one hand and water relationships in the same connection on the other.

At present the eyes of the world are turned to the tropical regions as potential new sources of food and raw materials, but their efficient use largely depends on the elucidation of these matters by research.

## *Problems of Tropical Africa . . .*

THE problems of tropical Africa are among the major issues confronting the world today and, as this vast area is mainly dependent on agriculture, they take their roots primarily in matters relating to land use.

There is an enormous and growing volume of literature on this subject. The work which has probably exercised the greatest influence in directing attention to these questions is, of course, Lord Hailey's monumental 'African Survey,' but it has been followed by an unceasing spate of books, reports, papers, conferences and lectures, from all of which the magnitude, the importance and the baffling nature of the problems emerge with some clarity.

Among these is a paper recently read before the Royal Society of Arts by Mr. W. V. Blewett of which we hope to be able to reproduce a condensed report in a subsequent issue. In the course of it he called attention to the report of the three U.S.A. experts who visited Africa in 1949 in accordance with President Truman's suggestion that America should help in the development of backward areas —the " Three Wise Men " as they have been termed.* These experts made it perfectly clear that the amount of effort at present being directed to solving the numerous problems is but a fraction of what is needed and that considerable additions both to scientific personnel and to resources will be required if the knowledge essential to the solving of the problems is to be forthcoming in reasonable time.

*See *World Crops*, 1949, 1, (1), p. 27 and 1, (4), p. 151.

As a contribution to this end they suggested the secondment of teams of American scientists to work in Africa for limited periods. We understand that this proposal is being examined carefully by the Colonial Office and it is hoped that it will eventually be found possible to implement this generous offer, for the need for help is urgent and incontestable.

## . . . and their social implications

While the need for increased scientific knowledge is incontestable if the clamant problems of tropical African agriculture are to be effectively solved, improvement is impossible unless the social and economic conditions of the population are such as to enable the fruits of research to be applied in practice.

In Africa it is in this regard that some of the chief dangers reside, particularly in relation to the problem of increasing the efficiency of native agricultural methods. Point is given to this reflection by a recent article by Mr. Colin Maher, Senior Soil Conservation Officer in Kenya, on social and economic problems and their relationship to soil erosion in that country, which appeared recently in *Soils and Fertilisers*. Mr. Maher's remarks apply particularly to Kenya, but they also have a bearing with due modification to many other territories in Africa, as was in fact pointed out by the editor of this journal in a recent lecture to the Royal Society of Arts.

Quoting Dr. Charles E. Kellog, Mr. Maher indicates that ' the remedy for soil depletion must come along with a remedy for the social problems.' He further points out that in Kenya rapidly rising native populations has led in places to excessive pressure on the land; in many native areas the productive capacity has fallen by not less than 50% in consequence, while the growing needs of an increasingly sophisticated indigenous population is leading to ever-increasing exploitation of the soil to supply the cash needed to satisfy them.

Added to this there is a growing spirit of independence fostered by a clique of politically-minded Africans which, although it may not be shared by the masses, is a definite drag on the development of a balanced economy. Indeed the desire for political independence is outrunning the growth of economic self-sufficiency. To all this must be added a common lethargy and lack of drive among Africans, often coupled, we might add, with lack of appreciation of the dangers.

The parallel of this is seen elsewhere in Africa. Thus in Nyasaland it has been pointed out that, whereas in some districts steady improvements in native agricultural methods have occurred, there are few in which this has not been due to strong pressure from the authorities.

Again in the eastern provinces of Nigeria, where a dense population is concentrated on a soil of low fertility, obstacles to the introduction of improvements are the extremely complicated system of land tenure and the social structure of the people over whom there is little authority and who resent interference with their freedom of action. It is easy to suggest ideal solutions, but no practical solution can be achieved unless the social system can be modified.

The conclusion seems inescapable that a direct conflict may be arising between Western democratic ideals and the application of the new agricultural methods which Western science has shown to be practicable and which represent the only means of avoiding threatening disaster.

## Hill grazing

MUCH attention has been paid of recent years to the possibilities of improving hill grazings in the United Kingdom as a means of adding to the supplies of home-produced food. The work and writings of Sir George Stapledon and many others have thrown the subject into high relief, while the provisions of the Hill Farming Act are intended to facilitate and consolidate the rehabilitation of hill economy.

A recent article in *Agricultural Progress* traces the history of hill farming with special reference to Wales and shows how emigration from and progressive neglect of the hill farming areas during the latter part of the nineteenth and the first part of the twentieth centuries became a festering sore that sapped the old established economy, while the long depression of the inter-war years completed the catastrophe. Hill lands that were formerly well cared for degenerated into useless areas given over to bracken, bramble and morass.

The problem is by no means confined to the United Kingdom; it is in fact universal. With the ever-increasing world population it is obvious that mankind cannot afford to neglect the less propitiously situated lands as potential sources of production, and it is a sobering reflection that, in the United Kingdom at least, where the demand for increased food production is so urgent, far less effective use is being made of these lands today than was the case a couple of centuries ago.

In tackling the problem, comparisons between conditions in one country with those in another are always valuable and, on this account, the article which appears on another page by Mr. R. Bruce Levy, Senior Pasture Specialist in the New Zealand Department of Agriculture, is particularly interesting. The author has recently completed a tour of the hill-grazing areas in the United Kingdom and, in the article in question, he records his impressions, contrasting and comparing the problem as it appears under British conditions with what obtains in the parallel though not precisely similar aspects

in New Zealand. Probably all may not entirely agree with some of his conclusions, but it is always helpful and stimulating to know how conditions strike the other fellow.

It is encouraging at least to know that under the stimulus of modern ideas and modern needs the pulse and tempo of hill farming are increasing appreciably in many areas in this country, and that a similar intensification is also appearing in New Zealand.

The introduction of the modern tractor with its battery of mounted implements and the demonstration that its power and flexibility can be applied successfully under what formerly seemed to be almost impossible conditions is an advance of the utmost importance. Here we invite a reference to an illustration on p. 225 of our May number which shows a Fordson Major tractor breaking up pastures hitherto considered inaccessible to tractors and implements. There is also a considerable body of technical knowledge on preconditioning, ploughing, liming, fertilising and reseeding hill land, and it can be said that near appropriate techniques suitable to varying conditions are now available. The present need is that all this knowledge should be applied as extensively as possible.

Mr. Levy makes a special plea that the rehabilitation and development of hill lands should be regarded as national undertakings to develop unutilised assets, much as reclamation by drainage or the installation of irrigation are regarded in other conditions, and treated similarly when the provision of the necessary finance is envisaged. With this view we c ın express unhesitating agreement.

## *Partial sterilisation of soil*

IN a recent paper read before the Agriculture Group of the Society of Chemical Industry, Dr. O. Owen described the results of recent research carried out at the Cheshunt Experiment Station (the functions and work of which, incidentally, are outlined in this issue) on the effects of partial sterilisation by heating on greenhouse soils.

The beneficial effect of heat on soils has, of course, been known from very early times; Virgil refers to it in the Georgics, while in India the process known as rab burning is mentioned in the Vedas. More recently the effect has been the subject of considerable investigations, the most widely known of which are the classic researches of Sir J. Russell and J. B. Hutchinson between the years 1908 and 1913.

The effect is due to modifications in the microbiological population of the soil as a result of the treatment and is shown by a rapid increase in the ammonia and nitrate content of the soil.

Steam treatment of greenhouse soils used in intensive horticulture is a regular feature of market garden practice, and Dr. Owen showed that on soils of this type the first effect of steaming is a marked increase in the ammonia content coupled with some decrease in the nitrate content of the soil, followed by a decrease in ammonia and a rapid rise in the nitrate content. The effect was greatest in soil that had never previously been steamed and, somewhat contrary to expectation, the increases recorded when previously treated soils were inoculated with untreated soil were lower than in the case of virgin untreated soils.

Attention has been directed by a number of workers, notably Griffith in Uganda, to the rise in the nitrate content of soils of the sub-humid and semi-arid tropics when they are bare fallowed during the dry season. In the West Indies also it has been shown that a period of bare fallow prior to planting cotton in the drier islands is beneficial, presumably for the same reason, while as has been shown above, the beneficial effects of burning are probably due to the same cause.

Although a number of explanations have been put forward as to the exact mechanism of the changes, there is still some divergence of opinion on the subject; it is, however, clear that it is a complex matter and a number of factors are involved including bacteria, moulds and other fungi, and soil-inhabiting protozoa. The effect on the soil colloids and on the soil organic matter have also to be taken into account, while the incidence of the various factors may and probably does vary with conditions.

Be this as it may, the recent work at Cheshunt appears to be a useful contribution to one aspect of this intriguing subject and one which may have a bearing on agricultural practice under conditions far remote and widely differing from the highly specialised greenhouse horticulture in the Lea Valley.

## *Spare the bees*

AN injunction by the English Ministry of Agriculture to ' spare the bees ' has recently been issued as a reminder to farmers and fruit growers before seasonal spraying and dusting operations are started. This warning, in fact, finds application in regions far beyond the confines of the United Kingdom. It is, indeed, no new problem, for as long ago as 1944 widespread loss of the clover seed crop in parts of the U.S.A. was reported owing to indiscriminate dusting with DDT in an effort to control the malaria mosquito, which, although it was successful in its main object, involved the destruction of the bee population responsible for the fertilisation of the flowers.

For fruit growers especially honey bees perform a necessary and beneficial service by pollinating the

flowers, and this action, to a large extent, determines the size of the subsequent harvest. If the bee population is reduced greatly for any reason, the result is seen in diminished yields and consequent loss.

The toxic effects of modern sprays and dusts on bees are very definite and the problem of protecting the beneficial insects is not likely to diminish; in fact, it looks as though it will reach serious proportions in the future as modern arsenical sprays and dusts, DDT and BHC compounds become more widely used, unless growers take what precautions they can to reduce risks of poisoning bees. Every effort must be made to avoid spraying open blossom of any kind and use of DDT and BHC insecticides should be confined to the period before blossoming. Colonies of bees should not be put in orchards until early varieties of fruit are actually in bloom and they should be removed from orchards before ' petal fall ' spraying. Provision of water in a sheltered and sunny spot near the orchard will supply their needs and reduce the chances of their drinking from moist places under trees which may be contaminated by chemicals.

Another problem, mainly for the farmer, is the control of pollen beetles in brassicas grown for seed, for it is difficult to effect a control except during the flowering period, which is just the time when bees are likely to be most active and heavy casualties may occur. In those areas where brassica seed crops are grown extensively it is as well for bee-keepers to consult local growers about their plans for seed crop production and so face in advance the problems of possible loss by poisoning.

It looks as though ' where the bee sucks ' has now become a place fraught with danger as a result of scientific advancement and a satisfactory solution to the problem is yet to be found.

## *Agricultural man-hours*

ONE of the most promising subjects of agricultural technology still receives grossly inadequate recognition, despite the fact that excellent results follow whenever its principles are properly applied. This subject is labour study, farm labour organisation, or farm work simplification; it can, broadly speaking, be given several titles. In industry, time and motion study has long played an important part in production economy. Unhappily, deep-rooted prejudice is liable to be aroused whenever it is suggested that ' factory methods ' can be usefully introduced into farming. In the past, attempts to overcome this prejudice have had a sorry and ineffective history. In Britain between the wars the National Institute of Industrial Psychology tried to secure the interest of farmers and farm workers in more efficient systems of work and improved farm layouts, but in the end this valiant attack was abandoned.

However, the acute shortage of labour during World War II stimulated new efforts at a number of centres in both Britain and the United States. Such striking economies have been obtained that it seems almost tragic that this eminently practical type of agricultural research is not more widely known. Unlike most kinds of agricultural research, all the experimental work is carried out on the farm. The interest and co-operation of farmers should be easy to secure. There are no samples taken away to obtain a laboratory verdict, and nothing is measured which farmers themselves cannot readily understand.

The primary research operation is a ' time and work ' analysis of a particular farm operation. In one British case silage making was studied and it was shown that three men, trained to carry out the operation by an improved routine, but without additional equipment, could be as effective as the team of seven men normally used. The principal factor of inefficiency was the organisation of the work so that one man, the strongest, was kept all day on the heaviest task, and as a result the output of the entire team steadily fell as he tired. A system in which all tasks were interchanged at intervals more than doubled the output per man-day. Studies of Burley tobacco production in Kentucky led to improved working methods which saved 10 hours per acre in pulling plants, 11 hours per acre in machine setting, 19 to 20 hours in priming, and between 20% and 40% in cutting and spearing labour. In Florida a study of the labour arrangements in celery production, harvesting and packing led to a total saving of labour requirements of approximately 40%. Recently changes of layout and work organisation on one farm in Northern Ireland yielded a saving of 376 hours of work per year and reduced the distance walked per year on the farm by 140 miles. Similar study and reorganisation on a small American dairy farm reduced the time spent daily by the farmer-worker on routine tasks by just over 2 hours and his daily walking from $3\frac{1}{4}$ hours to $1\frac{1}{4}$ hours.

There is much more in the mechanisation of farming than the introduction of suitable machines to perform tasks previously done by hand and hand-tools. The advent of the machine is only the beginning; the most effective method of ' working ' the machine must be discovered, and it is not necessarily the first system which is tried out which is the best.

---

***The Coconut Industry of Ceylon***

The author, Dr. R. Child, of the above article which appeared in the March number of 'World Crops' has asked us to point out that the photograph at the top of p. 105 does not illustrate a copra storehouse as captioned, but shows a Pearson patent copra drier.

# Hill Country Grasslands

## Part I

E. BRUCE LEVY

*Director, Grasslands Division, Department of Scientific and Industrial Research, Palmerstown North, New Zealand*

***Hill grazing is a great potential source of wealth to British agriculture, but much of our hill country is still derelict and empty. The author, an eminent authority on grassland in his own country, has recently travelled throughout the United Kingdom studying highland and lowland grass, its management and possibilities. In the following article, which will be completed next month, he compares conditions in Britain with those in New Zealand.***

IT is generally conceded that there is a relationship and interdependence between the lowland fattening country and the hills that produce the stores and the female stock that beget the flow of fat lambs, baby beef and fat cattle from the lowlands. It is not denied that the lowland country could breed its own female and replacement stock, but nationally this would be a suicidal policy, since the production of fat lambs, baby beef and fat cattle would be diminished automatically by the number of animals that would have to be bred and carried each year as breeding stock. In addition, two sets of male stock and breeding flocks would need to be run to provide respectively for the breeding stock and for the crop of fat lambs, while the question of stamina is also important.

**Rotational grazing on the hills, together with a top-dressing, can extend fat lamb production on the easier hills**

### Highland and lowland utilisation

In any event, where a country has only a limited amount of flat, ploughable land and a preponderance of hills, the national policy should be to make the maximum possible use of its natural resources, and to adjust flat and hill grazing to the maximum benefit and mutual advantage of each.

In such a policy consideration must be given to the role which the various aspects of livestock husbandry should occupy. In the matter of demand for ease and convenience of grazing, for nutritious feed and in cash returns for feed consumed, the dairy herd comes foremost. It is accordingly reasonable to earmark the best of the lowland ploughable lands for dairying. Next in importance is the provision of ample milk-producing and fattening feed for the breeding ewe and her lamb, and for fattening cattle. Much undulating and fairly readily top-dressible country comes into this category, and there is ample evidence, both in New Zealand and in Britain, to show that the area of such fattening country could be vastly increased. Finally, there are the large hill country areas, often far from railheads and good roads, where top dressing is at present out of the question and where the production of store stock must remain the prime function. It is possible, of course, that aerial and other mechanical aids to top dressing may alter the position on this type of country within a few years.

### Hill country in New Zealand

In New Zealand there are three major classes of hill country: (1) The moderate to heavy rainfall country which originally

**Hill country development; forest to grass in New Zealand**

carried dense rain forest; (2) Scrub- and fern-covered hills with a relatively low rainfall, mainly on the east coast; and (3) Natural mountain tussock country mainly of high elevation which occurs predominantly in the South Island.

Classes (1) and (2) have been brought under grass by clearing the forest, fern and scrub by axe, fire and surface sowing of grass and clover seed mixtures. Both cattle and sheep are grazed and it is held that it is necessary to mix the two in ratios varying with the class of country. In the wet rain forest country the accepted ratio is one cattle beast to five sheep, and in the drier country, where secondary growth is easier to combat, the ratio may be as high as one cattle beast to ten sheep. The best results have followed mob grazing on a rotational basis. Hard, close and continuous grazing with sheep has encouraged the spread of undesirable forms of secondary growth that could have been eliminated by rotational mob grazing with sheep and cattle. Cattle, in the earlier phases of the establishment of grazing, must be regarded as the hill country implement and the manner in which they are used may often determine the success or failure of such efforts. It must be remembered that grass alone is no match against the efforts of forest, scrub or fern to recolonise the land and a balance must be maintained, either by periodic use of the fire stock or of grazing animals that eat and trample on the fern, scrub and secondary growth as this appears. Shrubby growths that no class of stock will eat, must be felled or grubbed out and, if they are dense, burnt and the land resown with grass. Top dressing with phosphate greatly encourages growth of sward and ensures sustenance for more stock which, by their greater numbers, can more readily subdue the secondary growth.

### Secondary growth control

For some of the more shrubby secondary growths, particularly the exotic blackberry, goats, in conjunction with sheep and cattle, have been effectively employed. In New Zealand, practice favours the use of the fire stick and grazing stock to control secondary growth, rather than the axe or grubber. The use of fencing to control livestock movement and to work the lands to the best advantage is also very important.

In tussock country the ecological problem is different from that of forest, fern or scrub country. In the latter the aim is to

**The hills provide the store cattle for the lowlands to fatten**

destroy entirely the top covering of fern and secondary growth, but in the former, the top growth must partially, at least, be preserved and opened up only sufficiently to enable light to penetrate to the ground, thereby encouraging development of the finer native grasses and herbage plants. The infiltration of light also facilitates the ingress of some of the hardy exotic grasses and weeds that can contribute considerably to reviving the naturally low carrying capacity of the country, of which the habitat is hard and the rainfall low. In these conditions Merino sheep predominate.

Widespread devastation of tussock country has followed too frequent burning and overgrazing, while rabbits have also been a source of difficulty. Whereas a grass sward follows the elimination of the forest, fern and scrub growth, bare ground or a mat-like growth of scrub weed succeeds the destruction of the top cover of tussock. In such cases the bringing back of the tussock and associate herb and bottom grass cover usually involves long periods of complete rest and the destruction of rabbits. Several large blocks which have been so treated, combined with some oversowing of seed, are now showing promising regeneration and cattle are again being grazed upon them.

### New Zealand hill country compared with Britain's

A comparison between the hill country of New Zealand and Britain is not easy, but it is instructive. The climate of the British hill country is its greatest enemy and in this regard New Zealand can probably give Britain 1,000 to 1,500 ft. in elevation before conditions climatically similar are attained, *i.e.* conditions in Britain at 1,500 ft. are comparable with those at 3,000 ft. in New Zealand. Most of the New Zealand hill lands, apart from the upper tussock country, are below 2,000 ft. altitude, while the upper forest is at approximately 4,000 ft., and the highest sown grassland at some 3,000 ft.

There is more rain and mist on the hills of Britain, and the perpetual dampness and dankness during the winter has led to leaching and acid soil conditions which militate against the breakdown of surface vegetation, resulting in the formation of a definite peat layer which presents a difficult problem in efforts to improve mechanically the soil conditions. Nowhere in New Zealand does this acid

**Stage in the regeneration of the forest; hard close and continuous grazing by sheep is contributory to this grassland deterioration**

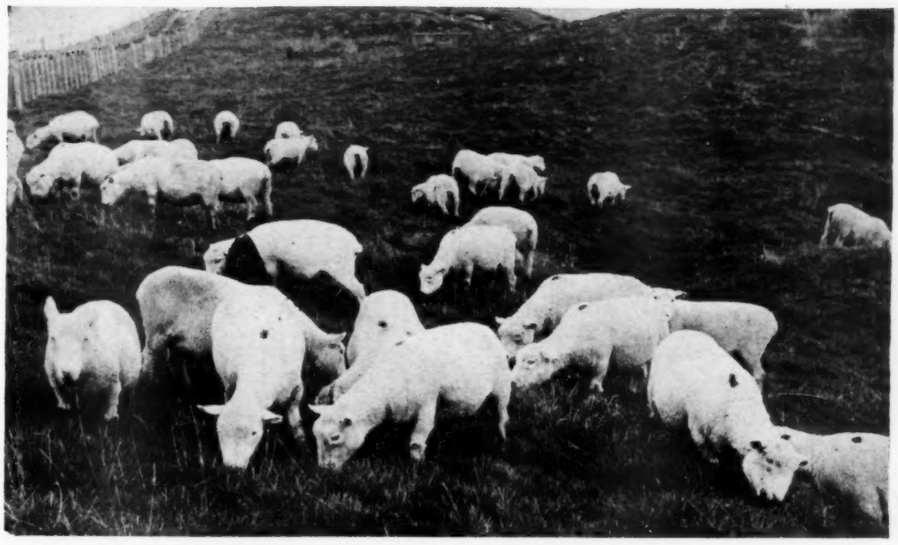
peat layer exist below the 3,000 ft. level; consequently hill country in New Zealand is just as amenable to treatment as is lowland country, apart, of course, from difficulties due to steep slope. Given fertility and good strains of grasses and clovers, however, its carrying capacity can be raised up to three to four ewes per acre plus some cattle. On some of the New Zealand hill country, of course, rock, sandstone and shale appear right up to the surface and with this type of country it is difficult to do much.

### Soil erosion in New Zealand

On the other hand, in New Zealand hill country soil erosion is a much more serious threat. The land is steeper and more dissected while the soil lacks the protective cover of surface peat; it is, indeed, at the moment, hard to say whether New Zealand is entering a new phase of accelerated erosion. It is, however, certain that the only thing betwixt heaven and a bare erodible soil is a thin veneer of grass, and it remains to be seen whether this is in itself sufficient to withstand erosion, or whether it will be necessary to supplement it by turning the hill country into a form of savannah where deciduous trees, spaced at more or less regular intervals or at strategic spots, reinforce, as it were, the surface cover of grass and top soil and help to prevent large-scale wholesale movement to lower levels.

### New Zealand pasture plants

As far as pasture plants are concerned the New Zealand hill country can rely on fairly high-producing and palatable grasses such as perennial ryegrass, cocksfoot, crested dogstail and white clover on the better slopes and camps; on brown top, Yorkshire fog, Lotus major (wetter slopes), and subterranean clover (drier slopes) on moderately fertile soils; and, in general, on *Danthonia pilosa*, rats tail, N.Z. ricegrass, *Poa pratensis*, sweet vernal and a host of annual clovers, of which the most important are subterranean clover, suckling, clustered, straited, *Lotus hispidus*, *Lotus angustissimus* and hares foot trefoil. I would put the absence of these self-seeding annual clovers in Britain as one of the outstanding ecological differences between the hill country grasslands of the two countries. Perennial *Lotus corniculatus* var. is perhaps the nearest British counterpart; this species is absent in New Zealand, as are also the two British low-fertility grasses, Nardus and Mollinia. Chewing's fescue, or some other British red fescue counterpart, as well as brown top, stunted Yorkshire fog and sweet vernal are common to the hills of both countries.



**Improvement of hill country by top-dressing, by oversowing of seed and spelling. Controlled grazing with these practices can extend the area considerably for the production of fat stock and forward stores.**

### Secondary growth and its control

Both New Zealand and Britain are alike in that secondary growths have to be controlled to preserve the grassland from being overwhelmed by shade. A good deal of Britain was originally forest and the secondary growths are presumably a reflection of the efforts of forest or scrub-land to re-establish itself, as is the case in New Zealand. The British Ericas, Calluna and the bracken fern are the counterparts of the New Zealand bracken fern, Manuka, Pomaderris and other scrub growths that preface the return of the forest. In many parts of Britain today the second phase is taking place and thickets of hawthorn, hazel, silver birch, etc., are being invaded by ash, chestnut, oaks, etc.; presumably, if conditions remained undisturbed, much of Britain would revert to forest. Workers in Britain connected with the war-time effort to bring back into cultivation derelict scrub and tree-clad country need no convincing of the forest's tendency once more to gain control of the land.

The surest and quickest means of controlling secondary growths is by the plough, which turns everything under and gives an opportunity to restart growth with sown grasses and clovers. In Britain ploughing can also go a long way to destroy the surface peat mat which offers little or no opportunity for establishing seed beds for grasses and clovers.

### Importance of livestock

On unploughable country cattle, mob-grazed on a rotational basis, are the most effective implement and, personally, I cannot see any practical method of control of fern and secondary growths that does not include the use of the grazing animal.

Strict control of the grazing animal is, however, imperative and it is of little use trying to crush secondary growth unless the country is fenced and suitable grasses and clovers are present in sufficient quantity to feed the stock and enable them to crush undergrowth effectively.

It must be borne in mind that Nature will not tolerate bare ground and therefore it is important to introduce suitable pasture plants and if possible to build up soil fertility to a point that the sward itself will compete with the secondary growth and aid the cattle in the process of secondary growth control.

### Grazing management

In New Zealand, if hill country is closely and continuously grazed with sheep, a host of difficult weeds, ferns, shrubs and secondary growths make their appearance. If these are controlled by cutting and burning, the results are a low-producing sward of Danthonia on the dry hills, and of stunted brown top with lots of moss in the wetter and shadier country.

Possibly the incursion of Nardus, red fescue and stunted brown top (Agrostis) on British hill country is a result of uncontrolled wide range, set grazing and perhaps there would follow a distinct improvement in growth and botanical composition if rotational mob-grazing could be practised. The withdrawal of cattle from hill country farming in Britain on the score of enforced economy or lack of financial returns is, in my view, a weakness in British hill country development, and I believe that eventually cattle must come again to the hills.

*(To be concluded in our next issue)*

# Crops Under Glass in the Lea Valley

W. F. BEWLEY, C.B.E., D.Sc., V.M.H.

*Director, Experimental and Research Station, Cheshunt, Herts.*

THE valley of the River Lea, that tributary which flows into the Thames near Tidal Basin, is one of the most important horticultural areas of Great Britain, for it is the largest single area of glasshouses in the world.

The tomato is by far the most popular crop and during the war years practically the whole of the area was devoted to it, only a small proportion of the glasshouses being used for maintaining valuable stocks of flowers which, if lost, could not be replaced. Prior to the war, when the areas devoted to different crops had stabilised themselves, there were approximately 1,200 acres of tomatoes, 200 acres of cucumbers and 100 acres of other crops, including cut flowers, pot plants, grapes and mushrooms.

### The inception of the industry

Long before the first glasshouses were erected in the Lea Valley plant nurseries existed around the fringes of London, supplying gentlemen's gardens with plants and seeds. Some, like those of Bull, Weekes and Veitch, possessed show glasshouses in which they displayed their choicer plants. At that time glass was becoming cheaper and nurserymen were not slow to appreciate the business possibilities of growing crops in the protected conditions of glasshouses, and nurseries like those of Mr. Kay at Finchley, Mr. H. B. May at Edmonton, and Mr. J. Rochford at Page Green, were among the first developments.

*The large-scale production of certain horticultural crops under glass to meet the demands for early produce in urban areas is a comparatively recent development. It has expanded enormously in many countries both in Europe and elsewhere. It is probably not universally realised, however, that the greatest development has occurred in the Lea Valley, north-east of London, where there now exists the largest single area under glasshouse cultivation in the world, the total area covered now exceeding 1,500 acres. Here is an account of the industry.*

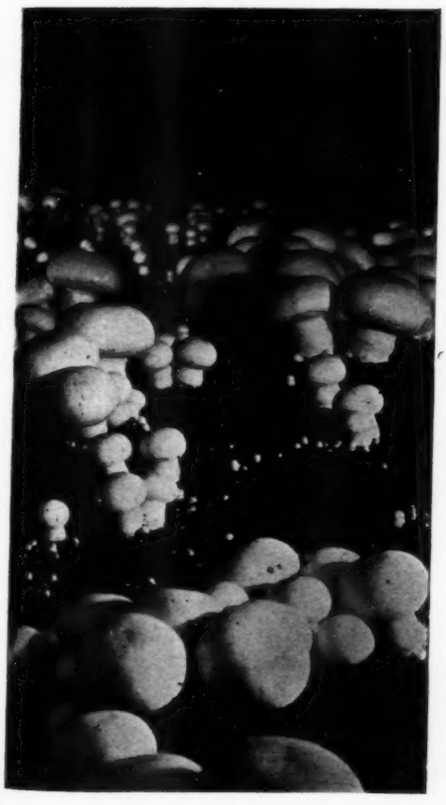
In 1882 came the first move away from London when Mr. Joseph Rochford left his father's nursery and settled at Marsh Lane, Turnford, in Hertfordshire. Here he erected a number of glasshouses and in so doing laid the foundation of this large and important horticultural area. Thomas Rochford, his brother, followed soon after and about the same time Robert Hamilton built ' Providence Nursery ' at Waltham Cross. In 1887, Mr. Joseph Rochford built his famous ' Jubilee House ' covering ¼ acre of land and grew first tomatoes and then grapes. This was probably the first

commercial crop of tomatoes to be grown in the Lea Valley. He also grew cucumbers, melons, ferns, flowers and bedding plants.

After 1890 the industry began to extend to other areas in the valley, especially to Cheshunt, Waltham Cross, Waltham Abbey and Hoddesdon. By the year 1900 there were 264 acres of glass in Cheshunt alone, and in 1929 this had increased to 667 acres. It is estimated today that the Lea Valley area which takes in parts of Middlesex, Essex and Hertfordshire, amounts to some 1,500 acres of glasshouses. For many years the Lea Valley district stretched along the river from Tottenham in the south to Ware in the north, extending only a mile or so on either side, except for two small bulges at Waltham Abbey and Goffs Oak. Between the two world wars, however, that part of the valley near Broxbourne overflowed into the Nazeing and Roydon districts while in the north there was an extension along the valley of the River Stort in the direction of Bishop's Stortford.

### Characteristics of the Lea Valley

It seems natural that the pioneers of this industry would choose the Lea Valley as the location of their ventures for they came from North London, and this then peaceful agricultural valley would appeal to them. The soil is a rich brick earth over a gravel subsoil, which is ideal for tomatoes and many other glasshouse crops, and as the area is near to London, cheap transport for their materials could be secured on the River Lea itself. As these growers were not interested in early crops at that time and did not understand the importance of good light, the fogs and poor light which are so typical of the Lea Valley from November to February did not deter them.



**Mushroom cultivation**

As the acreage of tomato production increased in the country, growers soon found that early fruit sold at a higher price, and so they sought a method for producing earlier and still earlier crops. It was then that the importance of good light during the winter months became obvious, and today many Lea Valley growers have migrated to the sunnier parts of the country and have started highly-successful nurseries in the South and South-West of England.

### Development of the industry

Great credit is due to those who shared in the development of the Lea Valley area for many valuable discoveries. Mr. Joseph Rochford, for instance, invented the Rochford tubular boiler which, with slight modifications, is still used today. He also conceived the idea of building glasshouses in blocks instead of singly. Later Mr. J. Harnett and Mr. R. L. Glasspool used their steam sterilising boilers to increase the temperature of blocks of tomato houses by injecting steam into the hot water pipes in such a way that they raised the temperature of the water and increased its rate of circulation at the same time, thus foreshadowing the steam and water method. Mr. H. O. Larsen was the pioneer of modern grading and packing of tomatoes and when the National Mark Scheme came into being it adopted the Lea Valley methods of grading and packing with few alterations.

### Problems and difficulties

The first years of this great industry were uneventful except for the coming of new growers and the gradual extension of the area. Later, however, problems began to arise which worried the growers seriously and they began to search in all directions for assistance. Prof. Lefroy of London University and Mr. Massee of Kew advised them about pests and diseases, while Sir John Russell of Rothamsted Experimental Station gave them valuable assistance with their soil problems and in the matter of soil sterilisation. Despite this, however, new problems arose continually and the growers saw that the only way to cope with the situation was to have an experimental station of their own.

**Tomatoes growing under glass**

### The Cheshunt research station

Consequently in 1913, with the aid of the Ministry of Agriculture and neighbouring County Councils, the Lea Valley growers set up their own research organisation in the form of 'The Experimental and Research Station,' Cheshunt, Herts. The first Director was Mr. A. B. Lister, a graduate of London University, but the outbreak of war in 1914 prevented any real research from being carried out and it was not until the end of hostilities that serious work was done. Mr. Lister resigned his appointment in 1921 and turned his attention to The Lea Valley Growers' Association and Nursery Trades, Ltd., two important business organisations created by the growers themselves.

The history of the Experimental and Research Station since 1921 has been one of steady progress. The buildings have been enlarged twice and the staff now includes 18 experimental and scientific officers. Its work is well known both in the industry and in the scientific world. It is safe to say that it has well repaid the money and energy expended upon its creation and maintenance, for the results of its researches have placed the glasshouse industry upon a sound footing and are a sure defence against any major disaster from the world of diseases and pests.

### Production

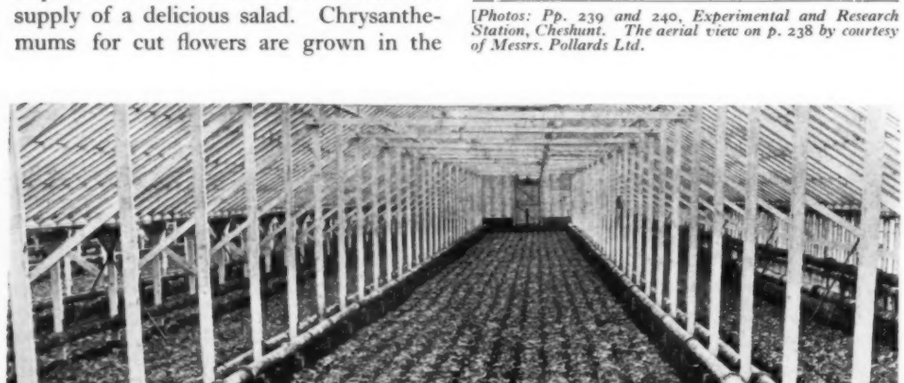
As a producing unit the Lea Valley occupies a high position. An average of 40 tons of tomatoes per acre is not a high figure on which to compute the total output of tomatoes from the Lea Valley, for many growers produce yields much higher than this, but it means 40,000 tons from 1,000 acres. Tomatoes, too, are wholesome fruit, rich in vitamins, and during the war they compensated to a considerable extent for the shortage of citrus fruit. Cucumbers average about 70 tons per acre and so the 200 acres of cucumbers before the war would produce not less than 14,000 tons of fruit. Melons are not very common in the Lea Valley, but at one time the long green marrow was frequently trained up the purlin posts in tomato houses. Crops of dwarf French beans are grown occasionally as a short crop after tomatoes, but the climbing French bean, popular on the south coast is rarely grown, except up the purlin posts. A useful winter crop is Cheshunt Early Giant lettuce—a variety raised at the Research Station. During the war one firm alone grew 1,000,000 heads each year and so provided the nation with a most welcome supply of a delicious salad. Chrysanthemums for cut flowers are grown in the autumn after tomatoes, but roses and carnations occupy special houses all the year round. The Lea Valley is famous for its roses, the cultivation of which for many years was entirely in the hands of the Stevens brothers, who at one time sent to market a very large proportion of the total supply. Pot plants including hydrangeas, azaleas, cinerarias, etc., and bedding plants were grown extensively during the early days of the industry, as were ferns and palms. They are still grown but on a smaller scale. Some growers force bulbs for early flowering including tulips, daffodils, hyacinths, iris and freezias, and at one time mushrooms were very popular.

Many peaches, nectarines and grapes used to be grown and the late Mr. H. O. Larsen exported peaches to New York, so excellent was his produce. The trees were cut out, however, during the first world war and were never replanted. Grapes have withstood the trials of two wars and are still cultivated by some specialists, who pack a very high quality grape.

### The present trend

The face of the valley has changed during the last 20 years. There has been a tendency for old nurseries in built-up areas to be pulled down and sold as valuable building sites and for nurserymen to move to the better lighted parts of the country, where earlier and heavier crops can be grown. Aerial activity during the second world war destroyed a small area of glass. Some of the damaged houses have been repaired, others have been salvaged and the sites sold. Most of the original, however, still remains and will no doubt continue for many years to maintain the reputation of the Lea Valley nurserymen.

*[Photos: Pp. 239 and 240, Experimental and Research Station, Cheshunt. The aerial view on p. 238 by courtesy of Messrs. Pollards Ltd.*



**Lettuces under glass**

## Canadian Government Urges Smaller Wheat Area

Canada's Minister of Agriculture continues to advocate a smaller wheat acreage in 1950 and future years, according to the Agricultural Attache, American Embassy, Ottawa. The recommendation calls for shifting some wheat acreage to summer fallow and feed grains, with a wheat target of 23 to 24 million acres suggested for 1950. Wheat acreage for the past 10 years averaged 23.6 million acres. Included in that average was the largest acreage recorded for Canada, 28.7 million acres in 1940. The average acreage for the preceding decade was 25.6 million and for the 10 years ended 1929 was 22.3 million acres.

At the annual Dominion-Provincial Agricultural Conference in Ottawa the Minister stated that a wheat acreage as low as 20 million acres would best serve Canada's long-time interest. A reduction to that low level from the 1949 acreage of 27.5 million acres, however, does not seem likely, and the higher figure of about 24 million acres is the one generally spoken of as the target.

### Possibility of wheat surplus

The Minister, in pointing out to farmers that the cut in wheat acreage would improve the pattern of farming in the grain belt, called attention to the possibility of world grain surpluses in the future. More stable prices for livestock products than for wheat, in the long run, were cited as another factor supporting a cut. Present relatively high prices, however, make grain production very attractive, especially since there is much less work involved than in livestock production.

Last year's acreage of 27.5 million acres was, with one exception, the largest wheat acreage recorded. The increase of about 3.5 million acres over the 1948 area took place, despite the Government's request for reduced acreage at that time. It is noted that any reduction must be on a voluntary basis, since the Canadian Government has no direct acreage control programme.

About 95% of the country's wheat is spring-seeded and subsoil moisture conditions at seeding time (April to May) are important factors in determining the extent of the acreage. A shortage of subsoil moisture over much of the Prairie Province wheat belt was reported during April. Threat of heavy grasshopper infestation was also considered rather serious.

**Stacks of bagged commodities about to be fumigated under a gas-proofed sheet**

# Fumigants for Pest Control in Stored Foodstuffs

W. BURNS BROWN, M.Sc., F.R.I.C.

*Pest Infestation Laboratory, Slough, England*

*In two recent articles in this journal, Dr. E. A. Parkin discussed the use of contact insecticides for the control of insect pests of stored foodstuffs. Present day trends in the use of the extensive range of insecticides which are classed as fumigants in a similar connection are reviewed in the following article.*

FUMIGANTS are used when rapid destruction is required of all insects or other pests throughout a bulk of foodstuff. In favourable circumstances a fumigant will penetrate into bags and boxes or throughout loose bulks of a commodity and can be effective against all stages of the pest even when these are hidden within grain, beans, nuts or other similar products. Fumigants are also employed in the disinfestation of empty warehouses and of flour mills and other buildings in which foodstuffs are stored or processed. Fumigation may be resorted to as the means for disinfesting the holds of a ship from which an infested cargo has been discharged, but a more severe treatment is required for this purpose than is necessary in the usual fumigation of ships for the destruction of rats.

## Fumigation of packaged goods

In the fumigation of all commodities handled in bags, cases or other packages the greatest assurance of effective disinfestation, coupled with safe operation, is given when the treatment is carried out in chambers specially designed and equipped for the purpose. Such chambers usually operate at atmospheric pressure, but there are in many parts of the world special installations using ' vacuum fumigation ' methods. There is some divergence of opinion on the relative merits of ' atmospheric ' and ' vacuum ' methods in chambers when taking into consideration the overall efficiency of each method, the ease and safety of operation and the economic aspects, including initial outlay on plant and operating costs.

## Warehouse fumigation

In the absence of specially designed chambers commodities are often fumigated in warehouses or sections of warehouses sealed off for the purpose. Sealing by means of sprayed plastic coatings has been tried in the United States and in Great Britain and has proved very effective. Although the materials are costly, this type of sealing has a much longer life than that given by the usual paste and paper methods and may prove more economical in the long run when fumigation is to be undertaken at intervals in the same building. A common objection to the fumigation of commodities in warehouses is the existence of a relatively large free air-space. This is wasteful of fumigant. The difficulty can sometimes be overcome by covering the stack of the commodity with a gas-proofed sheet of rubberised or plastic-coated material and introducing the fumigant below this covering. This technique can also be adopted when the commodity is stored in the open or in a building which cannot be sealed. In Great Britain considerable use is made of large sheets of balloon or dinghy fabric and the technique has been extended to the treatment of stacks of bagged grain, several of which are enclosed as a single unit by the use of a number of overlapping sheets, the edges of adjacent sheets being rolled together to form a seal which has proved remarkably effective. Similar use of numbers of sheets has been made in Australia.

## Fumigating in barges

In Great Britain in recent years, extensive use has been made of barges or

lighters for the fumigation of all types of commodities. These craft usually have steel hulls with solid wooden hatch covers which are sheeted over with two or three layers of interleaved tarpaulins of the heavy oil-dressed type. Many commodities are normally transported in these barges between ship and warehouse, in which case no additional handling is required for fumigation.

### Treatment of bulk grain

The fumigation of bulks of loose grain has been attempted under different storage conditions with varying success. In farm bins of the type in use in the United States and holding up to 2,000 bushels a variety of compounds and mixtures of compounds has been used, sprinkled over the surface of the grain. In Great Britain treatment in barges is undertaken by spraying a liquid fumigant above the surface. For grain stored in silo (elevator) bins liquid or granular fumigants can be mixed continuously or intermittently with the grain stream as a bin is filled, or liquid fumigant can be sprinkled over the surface at intervals during the filling of the bin. Alternatively, bins can be fitted with means for circulating the intergranular air so that a fumigant vaporised into the stream of air is rapidly distributed throughout the bin. This system, which has been in use in certain silos in the countries of Western Europe and in North Africa for some years, undoubtedly provides the most efficient method for the treatment of large quantities of grain. Grain stored in large bulks in single-storied sheds or in multi-floored warehouses presents the most difficult problem to the fumigator. The local treatment of ' hot-spots ' or other centres of infestation can do much to retard the development of a serious general infestation, but if this does arise the various types of fumigation which have been tested hitherto do not appear to provide a satisfactory measure of control except where the depth of grain does not exceed about 3 ft.

In all types of fumigation, whether of commodities or of empty premises, the aim must be the even distribution of fumigant in the shortest possible time. Methods of stacking bagged or packaged goods, multiple-point application of fumigant, the use of heated vaporisers and the provision of artificial means of stirring the air in the space to be treated must all be carefully considered as means of achieving this objective.

### Choice of fumigant

A wide range of chemicals has been brought into use as fumigants. The choice of fumigants in common use in a particular country may be largely fixed by considerations of availability and cost. Sometimes the advocacy of a single worker in the field of insecticides or the vigorous marketing methods of a manufacturer may result in the widespread adoption in one country of a fumigant which is little used elsewhere.

The fumigants in common use vary considerably in their toxicity to insects. All the more highly toxic compounds are also highly poisonous to man and the application of such fumigants should be left to specialists who appreciate the hazards involved and are trained to take all the necessary precautions.

High volatility is usually a desirable property, though for certain types of work the less volatile, higher boiling compounds have advantages. The inflammability of certain fumigants introduces additional hazards.

### Sorption

A factor which has become recognised as of great importance in governing the effectiveness of a fumigant is the extent to which it is sorbed by different foodstuffs and by packing and building materials. If sorption is high a large proportion of the dose of fumigant will be rendered ineffective and the presence of the sorbed fumigant at the end of the treatment may make ' airing ' a slow process. In addition, penetration into packages or through bulks of material is usually very slow when sorption is high.

Sorption may be purely physical, in which case the whole of the fumigant which has been taken up can be removed if the airing process is continued for a sufficient time. If insufficient airing is given, then the residual fumigant may be present in harmful amounts. In certain cases physical sorption is followed by chemical reaction with one or more constituents of the foodstuff and care must be taken to ascertain whether a normal treatment could cause any deterioration of the material. For example, taints might be produced, or the reaction products might be poisonous, or nutritive factors, such as the vitamins, might be destroyed.

### Fumigants available

(*a*) **Hydrogen cyanide** was one of the first fumigants to be extensively used in the control of pests in stored foodstuffs and, although for many purposes it has been largely superseded by the more recently developed fumigants, it still finds a wide field of use, particularly in the treatment of empty warehouses, mills and the holds of ships. The earlier method of generating the gas by the action of sulphuric acid solution upon solid alkali cyanides has been largely replaced by the use of pure hydrogen cyanide, either as liquid which is sprayed from cylinders into the space to be treated or as liquid absorbed on small cubes of kieselguhr or gypsum, from which the gas rapidly vaporises. A proprietary product containing about 50% of calcium cyanide in fine granular form has been used for the treatment of grain in silo bins, being applied continuously to the grain stream as the bin is filled. This material slowly evolves hydrogen cyanide as it reacts with the water vapour and carbon dioxide within the bulk of grain.

Hydrogen cyanide is one of the most toxic of fumigants to insects, but its effectiveness for many purposes is considerably diminished by its relatively high sorption on vegetable products, especially finely divided materials, such as milled cereal products, and on fibres, such as sacking. The vapour is, of course, highly toxic to man and it is one of the fumigants which should be handled only by trained operators. With most products the residual cyanide remaining after fumigation can be reduced to a harmless amount by allowing a sufficient period of airing. In dried fruit, however, some hydrogen cyanide reacts with one of the fruit sugars, laevulose, to give a stable compound which on ingestion dissociates to the free cyanide. The amounts produced do not appear to be harmful if the dose is carefully regulated and the treatment is carried out under conditions which produce even distribution of fumigant. Hydrogen cyanide continues to be used for the disinfestation of dried fruits in certain countries, particularly in vacuum fumigation plants, although in most countries methyl bromide is now favoured for the treatment of these products.

(*b*) **Carbon disulphide** has also been in use as a fumigant for many years, but it is now little used in those countries which have suitable alternative fumigants available because of the considerable explosion risk which attends its use. The lower inflammability limit in air is 1.25% by volume and it ignites spontaneously between 125 and 135°C. However, in some countries where availability and cost are prime factors it is still extensively used, particularly in the treatment of grain by sprinkling by hand or by spraying through pipes and nozzles.

(*c*) **Chloropicrin** is also less used than at one time, though it continues to be employed in the ' spot ' treatment of mill machinery and has also proved very effective in controlling surface infestations in silo bins. It is comparable to hydrogen cyanide in its toxicity to all stages of insects except the eggs, against which it has been

**Bagged flour specially stored in a barge for fumigation with ethylene oxide**

stated to be much less effective. It is highly lachrymatory, a property which is held to contribute to safety during handling.

(*d*) **Ethylene oxide** was introduced as a fumigant just before 1930 and rapidly found favour in the treatment of foodstuffs, since not only was it very effective, but there appeared to be no risk that the treatment would produce poisonous residues or affect the nutritive value of the foodstuff. It can seriously affect the germination of seeds, however. In sorption by foodstuffs it lies intermediate between hydrogen cyanide and methyl bromide. Unfortunately, its inflammability in air constitutes a serious hazard which is completely eliminated only by use of a mixture in cylinders of one part by volume of ethylene oxide and nine parts of carbon dioxide. This mixture has been used in the United States and before the war in Germany. In Great Britain ethylene oxide has been available only as a mixture of nine parts by volume with one part of carbon dioxide, the main purpose of which is as a propellant facilitating the application of the fumigant through piping and nozzles; this amount has little effect on the lower inflammability limit of ethylene oxide in air, which remains at about 3% by volume.

In Great Britain since 1940 considerable use has been made of a method of fumigation in which crushed solid carbon dioxide is first distributed above the commodities to be treated and the usual ethylene oxide fumigant is applied after an interval of a half to one hour. The carbon dioxide is usually applied at a rate of 20 lb. per 1,000 cu. ft. of air space, the aim being the production of a concentration by volume of 10% or more. At such concentrations of $CO_2$ the susceptibility of most insects to ethylene oxide is appreciably increased and the dose of this fumigant can be reduced to a point at which the maximum concentration reached throughout the space as a whole remains below the lower inflammability limit. This procedure greatly reduces, even if it does not entirely eliminate, the explosion hazard. The risk is minimised when it is possible to stir the air in the fumigated space or when the solid carbon dioxide and liquid ethylene oxide are mixed and vaporised into the space using a simple form of heated vaporiser.

(*e*) **Methyl bromide** was first noted as an insecticide in 1932, but did not come into common use until about 1939, by which time laboratory and field trials had demonstrated its great effectiveness for a wide range of purposes. It is now one of the most widely used of fumigants. Its toxicity to insects is high, being similar to that of hydrogen cyanide, but its great effectiveness is due mainly to its relatively low sorption by many products and by timber and other materials of construction. As a result of this property methyl bromide penetrates more rapidly than most other fumigants into bagged and packaged commodities and is also removed more readily during the subsequent airing period. Some reaction is usual between the physically sorbed fumigant and the foodstuff, as a result of which a fixed residue of water-soluble bromide is produced. This reaction is mainly one of methylation of certain protein groups. The residues of inorganic bromide are normally quite small and they are not considered to have any harmful effect. Excessively heavy treatment of some products may give rise to a slight taint.

Methyl bromide is highly toxic to man and it should be handled only by operators familiar with its properties and with the precautions which should be taken. However, the bad record of accidents with methyl bromide has been associated mainly with its use as a fire extinguisher or with factory filling of containers. Since its toxic character has been properly appreciated by fumigators and reasonable precautionary measures adopted there have been no reports of serious accidents resulting from its use as a fumigant. In several countries addition of a lachrymatory or pungent warning substance has been advocated as a safeguard against careless handling of the fumigant and to draw attention to leaks from cylinders or piping or the compartment being treated. In Britain chloropicrin has been commonly used for this purpose and in present practice the mixture contains 2% of this lachrymatory substance.

Methyl bromide is normally introduced from cylinders through a system of copper or plastic tubing with spray nozzles attached. Advantage can be taken of the high density of the vapour to aid downward penetration into loose bulks of material, and in Great Britain it has been employed for the treatment in barges of bulks of grain and of undecorticated groundnuts.

(*f*) Aliphatic **chlorohydrocarbons.** Certain of these have been widely used as fumigants for many years. As a class they are much less toxic to insects than the fumigants already listed, but as they are also less toxic to man and, by virtue of their higher boiling points, more easily handled it has been possible to recommend their use by those who are not specialists in the application of fumigants. They have therefore found a ready field of use on farms and in small stores for dealing with small quantities of bagged commodities and for disinfesting empty bags. They have also been extensively used for treating grain in farm bins. They are usually applied from a sprinkling can, or by means of a stirrup pump or by other simple means.

The most popular fumigant in this class is a mixture of three parts by volume of

**ethylene dichloride** (1, 2-dichloroethane) and one part of **carbon tetrachloride.** Ethylene dichloride is the more toxic compound, but it is slightly inflammable and the carbon tetrachloride is added to produce a non-inflammable fumigant. The carbon tetrachloride may have an important effect on the distribution of the ethylene dichloride, particularly in the treatment of bulk grain in bins.

Carbon tetrachloride readily penetrates downwards through bulks of grain and in Canada, in spite of its low toxicity to insects, it has been used alone with apparent success in the treatment of grain in silo bins. More frequently, however, it has been used as a ' carrier ' for a more toxic compound. Thus mixtures containing one of the following compounds added in the proportion shown have each found favour with particular workers (mainly in the United States) for the treatment of bulk grain in farm bins or in silo bins: **methyl bromide** (10%), **ethylene dibromide** (5%), **chloropicrin** (15%), **1, 1-dichloro-1-nitroethane** (15%). Sometimes the 3 : 1 mixture of ethylene dichloride and carbon tetrachloride is used as the carrier in place of carbon tetrachloride alone. Little, if anything, is known about the behaviour of the components when these mixtures are applied to bulks of grain and a study of the effect of such factors as grain temperature on the distribution should be rewarding. The addition of the more toxic component inevitably increases the hazards to operators and, in general, the use of these mixtures by the non specialist is inadvisable.

(*g*) **Other compounds.** A number of other compounds continue to be used as fumigants as a result of well-established local custom or ready availability or because they appear to be suitable for certain specialised applications. Among these may be mentioned the alkyl formates, of which **ethyl formate** and **isopropyl formate** are used in Australia and in the United States for the treatment of individual packages of dried fruit and other commodities in the packaging line. **Methyl formate** is used in Germany for treating grain in silo bins fitted with a circulating system. The use of **mercury** vapour evolved from small receptacles containing the liquid has long been known to the peasants of India for protecting grain stored in closed pits. The main toxic effect is upon the eggs of insects. There has recently been some scientific investigation into its use with a view to devising new, safer methods of producing the vapour which would perhaps be applicable to the protection of larger bulks of grain. **Sulphur dioxide** produced by the burning of special sulphur preparations is still sometimes used, for example, in mill fumigation.

### New fumigants

Among more recent additions to the list of fumigants may be mentioned **trichloroacetonitrile,** developed in Germany as a substitute for hydrogen cyanide in house fumigation; **acrylonitrile,** which possesses a considerable toxicity to insects and which is being used in the United States in a 1 : 1 mixture with carbon tetrachloride for the local treatment of machinery in mills and bakeries; **methylallyl chloride,** with a higher toxicity to insects than the other simple chlorohydrocarbons, developed as a fumigant mainly in Holland; and **dichloroethyl ether,** which is being used in New Zealand for destroying mites on cheese.

### Conclusion

Under present-day conditions fumigation is frequently resorted to as the only means of dealing with a heavily infested product and arresting the deterioration of quality which may rapidly render the food unfit for consumption. In some countries, notably the United States, new standards of cleanliness are being demanded from all sections of industry producing food for human consumption and the presence of dead insects, insect fragments and frass, as well as rodent hairs, pellets and other ' filth,' will not be tolerated. It will be no solution to the infestation problems of the food industry in these countries to allow infestation by insects to develop seriously and then to rely on fumigation or other measures to kill the insects. It will usually be impossible to remove the evidence of infestation.

Fumigation should be undertaken as part of a control programme, the foundations of which are good hygienic handling and storage procedure and the proper use of contact insecticides. Such a programme should cover all stages of the movement of the commodity from primary producer to consumer, and if all who are responsible for handling or storing play their part infestation should never exceed a very low degree.

Table showing a list of fumigants in the order in which they are mentioned in the article.

| | *Formula* | *Molec. Wt.* | *B. Pt. °C.* |
|---|---|---|---|
| Hydrogen cyanide | $HCN$ | 27 | 26.5 |
| Carbon disulphide | $CS_2$ | 76 | 46 |
| Chloropicrin | $CCl_3NO_2$ | 164 | 112 |
| Ethylene oxide | $(CH_2)_2O$ | 44 | 11 |
| Carbon dioxide | $CO_2$ | 44 | — |
| Methyl bromide | $CH_3Br$ | 95 | 4.6 |
| Ethylene dichloride | $CH_2Cl.CH_2Cl$ | 99 | 84 |
| Carbon tetrachloride | $CCl_4$ | 154 | 76 |
| Ethylene dibromide | $CH_2Br.CH_2Br$ | 188 | 131.5 |
| 1, 1-dichloro-1-nitroethane | $CH_3CCl_2NO_2$ | 144 | 124 |
| Methyl formate | $HCOOCH_3$ | 60 | 31.5 |
| Ethyl formate | $HCOOC_2H_5$ | 74 | 54 |
| Isopropyl formate | $HCOOCH(CH_3)_2$ | 88 | 71 |
| Mercury | $Hg$ | 200.6 | 357 |
| Sulphur dioxide | $SO_2$ | 64 | —10 |
| Trichloroacetonitrile | $CCl_3CN$ | 144.5 | 85 |
| Acrylonitrile | $CH_2:CHCN$ | 53 | 78 |
| Methallyl chloride | $CH_2:C(CH_3).CH_2Cl$ | 90.5 | 72 |
| Dichloroethyl ether | $(Cl\ C_2H_4)_2O$ | 143 | 178 |

*This contribution is published by permission of the Department of Scientific and Industrial Research. Photographs are reproduced by courtesy of the Director, Infestation Division, Ministry of Agriculture and Fisheries. All illustrations are published with Crown copyright reserved.*

## Syrian Irrigation Projects

The £13 million (Syrian) allocated by the Syrian authorities for five irrigation projects will be spent mainly on the continuation and completion of schemes already under way. The five projects on which the funds are to be spent are (1) the Khabour plan; (2) the Kouek plan; (3) the Sinn plan; (4) the Er-Rouj plan; and (5) the Homs-Hama plan.

Of the total expenditure, £S3,600,000 is allocated for the River Khabour irrigation plan. Only the first part of this project is being tackled at present, and when the proposed four canals are constructed an area of 30,000 hectares will be made available for cultivation. A considerable amount of work has already been carried out on the first part of the project. The new allocation of funds will be spent on extending the main canal, connecting it with the Jagjag river (a tributary of the Khabour), and constructing auxiliary canals and distribution facilities. This year's expenditure is placed at £S2,200,000 and the remainder will be spent in 1951.

For the Kouek plan the allocation is £S1,300,000, and this will be used to complete work in reclaiming swamp land at Al Matakh, 30 km. south of Aleppo, which was started in 1946. The plan involves the construction of a network of canals on both sides of the River Kouek and will reclaim and irrigate 15,000 hectares of land. The new allocation of funds will be used to extend the irrigation network on the left bank of the river between El-ees and the villages of Mushrafi and Al Atshana, the construction of two tunnels beneath the railway lines to carry water, the building of two dams on the river itself and river dredging operations. £S800,000 will be spent this year and the remainder next year.

Both the Sinn plan and the Er-Rouj plan receive credits of £S4,000,000 each, and the Homs-Hama irrigation plan will be completed with the allocation of £S250,000.

# The Palm Oil Industry of Indonesia

J. GRINDROD, B.A.(Com.)

*Before the war the development of oil palm cultivation in Indonesia, and particularly in Sumatra, had attained impressive proportions. During the war the industry suffered severely as a result of the Japanese occupation. In this article the salient features of the industry are described and an account given of the progress made towards recovery. It may be read in conjunction with the article on the oil palm which appeared in our September 1949 issue.*

ALTHOUGH, before the war, the export of palm oil from Indonesia constituted 44% of the total supplies available to the world market from exporting countries and 24% of world production, the oil palm is a comparative newcomer to the East Indian Archipelago.

Up to the turn of the century Java was almost exclusively the centre of Dutch activities in Indonesia, but about 1900 the Netherlands Government extended its control beyond the island of Java in order to develop the resources of the Outer Provinces.

It was not, however, until after the year 1910 that oil palm cultivation began to extend, particularly in the north of the island of Sumatra, and then solely as large-scale planting enterprise. Since then palm oil and palm kernels have been produced extensively on European-owned and operated estates chiefly in Sumatra.

**A typical palm oil plantation in E. Sumatra**

### Characteristics of the oil palm

The oil palm came originally from the coastal regions of tropical West Africa, and a number of varieties are cultivated in Indonesia. The palm usually begins to bear fruit in the third year and reaches its maximum yield in the eleventh or twelfth. A palm in full fruit yields eight to twelve bunches of fruit, each weighing 40 lb. or more; 50% to 75% of this weight is accounted for by the actual fruit, the rest being stem.

The fruit consists of a nut surrounded by fleshy oil-containing pulp. Palm oil is extracted from the pulp; palm kernels are obtained by cracking the nuts and they, too, are oil bearing and are usually exported. Palm kernel oil, which is extracted in the consumer countries, is quite distinct from palm oil. After the oil has been extracted from the kernel the press cake is used as a cattle food.

Oil palm varieties differ considerably in the type of fruit they bear. In some there is a great deal of pulp surrounding a comparatively small nut, in others the proportions are reversed. The principal variety grown in Sumatra has as much as 60% to 75% of pulp containing some 50% of palm oil. Calculated on the weight of ripe fruit the palm oil percentage is therefore 29% to 32%, and calculated on the weight of the whole bunch it works out at 14% to 20%. In Sumatra, on well-equipped estates in full production, a palm oil percentage of 18% to 19% on the total bunch weight is obtained. The percentage of kernels is 3.5% to 4%, each kernel containing approximately 49% of palm kernel oil.

The yield of oil per acre from the oil palm is greater than that from any other oil-producing crop and in Sumatra the average pre-war yield was close on 3,000 lb. per acre.

The bunches take six months to ripen after the fruit has been set, and it is important that the harvesting should be done at the right time, as the yield from unripe fruit is low and the oil is inferior in quality. Colour is one of the main guides in determining the right time for harvesting. At first the bunches are deep red, but when oil begins to form in the pulp, which is only 24 days before the fruit is completely

ripe, a change to orange-red occurs at the base of the bunch which gradually spreads over the whole fruit. Ripeness coincides with the completion of the process.

### Uses for palm oil

Good quality palm oil is used in the production of edible fats and is an excellent basis for margarine. The oil is semi-fluid, has a pleasant taste and a slight fragrance reminiscent of violets. Its natural colour is yellowish-red, but when it is warmed to complete fluidity it becomes bright red; at higher temperatures it loses its colour. A constituent partly responsible for its colour is carotene, the precursor of vitamin A, and palm oil is one of the richest in this respect.

Although the characteristics of Sumatra palm oil have earned it a good reputation as an edible fat, its primary use so far has been in the soap industry. Palm oil itself makes a friable soap, but mixed with 20% of coconut oil, it is quite satisfactory for toilet soaps. Another industrial use for palm oil is as a flux in the production of tin plate, and in this connection it has proved to be the most suitable of all oils tried so far.

### Pre-war production

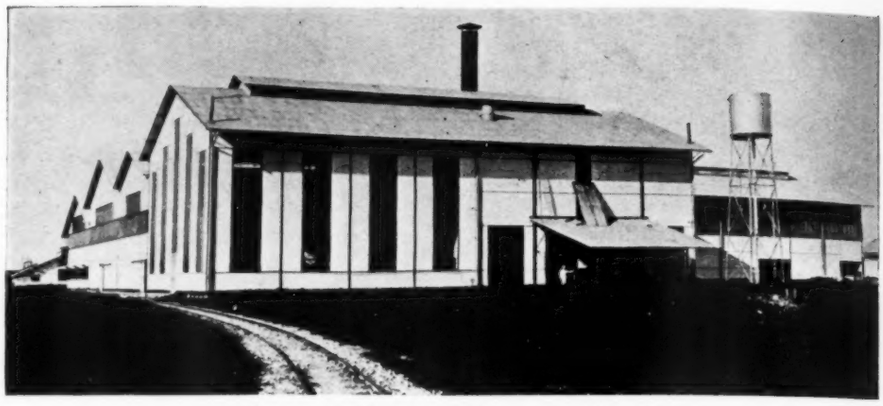
Although, before the war, oil palm products from the Netherlands Indies had become successful competitors with those from Africa, the total quantity exported still remained less.

Compared with the African product the quality of the Indonesian palm oil is much better and is distinguished primarily by its low percentage of free fatty acids.

The following figures for 1937 show the world export of palm oil and palm kernels from the producing countries, in 1,000 tons:

| | Palm Oil | Palm Kernels |
|---|---|---|
| Africa .. .. .. | 259 | 650 |
| N.E.I. .. .. .. | 197 | 41 |
| British Malaya .. .. | 43 | 7 |
| Total World Export .. | 499 | 698 |
| % N.E.I. .. .. | 40 | 5·9 |

An outstanding fact that emerges from these figures is the great differences in the proportions which exports of palm oil and palm kernels bear to each other. Africa exported 259,000 tons of palm oil and 650,000 tons of kernels; Indonesia, on the other hand, exported 197,000 tons of oil and only 41,000 tons of kernels. This is accounted for by the relatively high domestic consumption of palm oil in Africa, the higher oil content of the fruit in Sumatra, the more efficient methods of oil extraction used in Sumatra and the lower percentage of kernels in the varieties grown there.



**Palm oil factory with own railhead**

In the Netherlands Indies only about 3,000 tons of palm oil were used in local industries, principally in soap factories.

### Size of plantations

Small plantations are not suitable for oil palm cultivation and the normal size in Sumatra is from 3,000 to 4,000 hectares (1 hectare equals 2.45 acres). In 1940 there were 64 estates in Indonesia producing palm oil and palm kernels. Eight of these were in Java and Madura, while 56 were in the Outer Provinces (Sumatra). So rapidly has the industry developed that the area under oil palms trebled in the 15 years before the war and exceeded 100,000 hectares in all.

The factory installations are costly and, in normal circumstances, only very large concerns can be made to pay.

Production and export of palm oil and palm kernels from 1933 to 1940 is shown in Tables 1 and 2, which have been compiled by the Central Bureau of Statistics.

### Effect of the war

Such, then, was the position just before Pearl Harbour.

During the Japanese occupation and the subsequent civil strife which ravaged the islands of the Indonesian Archipelago many oil palms were uprooted and large branches torn down. Areas under cultivation deteriorated sadly through neglect and damage.

According to figures taken from records of the Japanese administration representing conditions as they were in August 1945, the total area in oil palm plantations was reduced from 106,000 hectares to 90,000 hectares. During the subsequent political disturbances further havoc was

TABLE 1. PRODUCTION OF PALM OIL AND PALM KERNELS, 1933-40
(In 1,000 kg.)

| | Palm Oil | | | Palm Kernels | | |
|---|---|---|---|---|---|---|
| | *Java and Madura* | *Outer Provinces* | *Total* | *Java and Madura* | *Outer Provinces* | *Total* |
| 1933 .. .. | 200 | 111,954 | 112,154 | 13 | 22,792 | 22,805 |
| 1934 .. .. | 156 | 130,491 | 130,647 | — | 24,878 | 24,878 |
| 1935 .. .. | 378 | 147,256 | 147,634 | — | 30,615 | 30,615 |
| 1936 .. .. | 673 | 174,563 | 175,236 | 6 | 36,130 | 36,136 |
| 1937 .. .. | 656 | 198,436 | 199,092 | 19 | 41,807 | 41,826 |
| 1938 .. .. | 887 | 225,781 | 226,668 | 73 | 47,963 | 48,036 |
| 1939 .. .. | 1,126 | 242,557 | 243,683 | 144 | 53,622 | 53,766 |
| 1940 .. .. | 1,245 | 238,643 | 239,888 | 25 | 20,376 | 20,401 |

TABLE 2. EXPORTS OF PALM OIL AND PALM KERNELS, 1933-40
(In millions of kg. net)

| *Destination* | 1932 | 1933 | 1934 | 1935 | 1936 | 1937 | 1938 | 1939 | 1940 |
|---|---|---|---|---|---|---|---|---|---|
| Netherlands .. .. | 13.4 | 15.4 | 28.2 | 29.1 | 39.3 | 34.6 | 63.8 | 55.4 | 19.3 |
| Great Britain and Eire .. | 8.0 | 4.9 | 10.3 | 1.3 | 4.7 | 1.9 | 11.9 | 36.9 | 11.3 |
| Germany* .. .. | 4.0 | 3.3 | 15.4 | 4.0 | 2.7 | 4.3 | 2.6 | 0.8 | — |
| Italy .. .. .. | 4.3 | 10.9 | 20.3 | 9.0 | 3.4 | 8.3 | 11.3 | 12.9 | 4.0 |
| U.S.A. .. .. .. | 53.8 | 78.9 | 43.4 | 97.9 | 119.7 | 142.7 | 114.8 | 104.0 | 107.4 |
| South Africa .. .. | 0.7 | 0.8 | 0.7 | 0.7 | 1.2 | 1.0 | 3.7 | 5.1 | 6.1 |
| Other countries .. .. | 0.8 | 2.1 | 3.0 | 1.2 | 1.4 | 4.1 | 12.6 | 16.5 | 29.8 |
| Total .. .. | 85.0 | 116.3 | 121.3 | 143.2 | 172.4 | 196.9 | 220.7 | 231.6 | 177.9 |
| Total value† .. | 11.8 | 10.7 | 8.7 | 13.6 | 21.4 | 26.1 | 16.5 | 15.8 | 9.6 |

*Since 1938 inclusive of Austria. †In millions of florins.

wrought. The actual war damage to the palm oil industry through uprooting, neglect, damage to buildings, factories and installations has been estimated at around 110,000,000 florins (1941 values). To this must be added post-war damage and that suffered through loss of profits.

Had it been possible to begin rehabilitation immediately after the Japanese surrender in 1945 the former export capacity of Indonesia could have been re-established by 1950 or thereabouts. As it was, political disturbances caused an extra delay of at least two years.

The most serious damage was sustained by the older plantations, and only a relatively small proportion of the valuable young plantings was cut down.

Several factories were badly damaged after the ' police action ' in 1947, but it was found possible to get most of them going again within a reasonably short time. During December 1947 conditions became safer and, one by one, factories recommenced work and estates continued to clean up and prune their plantations in spite of shortage of labour and its high cost—wages are much above pre-war level.

For instance, in the spring of 1948 news came through that the palm oil factory at Mata Pao was again working, and a second factory at Bangoen Bandar was expected to increase its output. The Goenoeng Bajoe concern, one of the largest palm oil factories in the world with pre-war capacity of 35,000 tons of oil yearly, re-started in December 1947 as well as those at Pebatoe and Tindjowan. Palm oil was being sold on the basis of 1,600 florins a ton under a contract between the Dutch Government and the Amsterdam Trading Association.

Later, in 1948, it was reported that on Sumatra's East Coast 18 plantations were under production with an area of 22,839 hectares.

These reports came from federal territory, from which, before the war, 70% of the output of palm oil was obtained.

TABLE 3. PALM OIL AND PALM KERNEL PRODUCTION IN 1938-48
(In 1,000 kg.)

| Year | Java | | Outer islands | | Total for federal Indonesia | |
|---|---|---|---|---|---|---|
| | Palm oil | Kernels | Palm oil | Kernels | Palm oil | Kernels |
| 1938 .. .. | 887 | 73 | 225,781 | 47,963 | 226,668 | 48,036 |
| 1939 .. .. | 1,126 | 144 | 242,557 | 53,622 | 243,683 | 53,766 |
| 1940 .. .. | 1,244 | 25 | 238,643 | 20,376 | 239,887 | 20,401 |
| 1941 .. .. | 1,177 | — | 197,106 | 1,248 | 198,283 | 1,248 |
| 1942 .. .. | 1,186 | — | — | — | 1,186 | — |
| 1943 .. .. | — | — | — | — | — | — |
| 1944 .. .. | — | — | — | — | — | — |
| 1945 .. .. | — | — | — | — | — | — |
| 1946 .. .. | — | — | — | — | — | — |
| 1947 .. .. | 3 | — | 573 | 60 | 576 | 60 |
| Jan./Oct. 1948 .. | 46 | — | 41,635 | 10,048 | 41,681 | 10,048 |
| Total, 1948 .. | — | — | — | — | 56,000 | 12,000 |

## Post-war production

During 1947, the production of palm oil was very small, but in 1948 it amounted to 56,000 tons in federal territory, of which 45,000 tons valued at nearly fls. 50 million, were exported, representing nearly 30% of pre-war output.

At Belawan-Deli, the port, installations for handling palm oil were being brought into service again, and the large storage tanks for palm oil were being reconstructed. Up to the time of writing 16 tanks had been brought into use again and the seventeenth was shortly to be completed. Dredging operations had taken place and it was possible for ships drawing 9½ metres and more to enter the port once again.

Early in 1949 it was announced that the United States had agreed to buy $3,970,000 worth of Indonesian palm oil to help build up strategic supplies under the Marshall Plan.

Shipments of palm oil from Belawan-Deli during 1949 are estimated at 100,000 tons, exclusive of the possible production of territories recently opened up on the East Coast of Sumatra where several more palm oil properties have started work again.

Table 3 shows the actual figures of production since 1938 to the end of 1948.

## The outlook

Immediately after the capitulation of Japan the import and export trade of Indonesia was concentrated in the Netherland Indies Government Import and Export Organisation (NIGIEO), but since the middle of 1946 this has been gradually liquidated though, in view of the foreign exchange difficulties, the Government still continues to exercise a certain measure of control.

The target for production of commercial crops in Indonesia for the next few years calls for increased output to provide export surpluses at about pre-war levels. In the case of palm oil (including the oil equivalent of palm kernels) the target for 1952/53 is 250,000 metric tons gross weight.

To enable this to be realised large quantities of imported consumer goods are needed to improve the standard of living, to encourage improved labour performance, and to maintain a generally reasonable price level.

Adequate supplies of materials necessary to production will also have to be made available such as tools, fertilisers, chemicals, etc., and also capital goods for reconstruction and replacements, since so far only provisional repairs and reconstruc-

**The fruit is sterilised in ovens**

tion have been carried out and more permanent provision will be needed as consolidation continues.

The restoration of law and order and the re-establishment of settled conditions are absolutely essential; unless this exists economic development is likely to be held up. This applies especially to the provision of new equipment, for there is little inclination on the part of Netherlands capital to supply capital goods while political difficulties continue, though investors may be willing to use money already available in Indonesia which, in any case, cannot be withdrawn. Much, therefore, depends upon the Republican Government.

Given peaceful conditions and economic stability, however, there seems no reason why the production of palm oil and palm kernels should not reach the target set for 1952/1953. Natural conditions in Sumatra are ideally suited to the cultivation of the oil palm, and it is in the interests of all that the potentialities should be once more fully developed.

**Oil is extracted from the nuts by hydraulic pressure**

*[Photographs in this article by permission of the Netherland Government Information Bureau*

# World Grain Crops Reviewed

A SUMMARY* of figures of production and trade, relating to wheat, wheat flour, maize, oats, barley, rye and rice has now been compiled by the Intelligence Branch of the Commonwealth Economic Committee. According to this publication world supplies of grain by 1948 were larger than just before the war, while the amount entering world trade was greater than for many years. The figures show the extent of the recovery attained, since during the war world output of bread grains (wheat and rye) declined by 30%. As the wartime output of feed grains (oats, barley and maize) had been fairly well maintained, only for rice was there some deficiency in output, and a larger deficiency in exports, in 1948.

The interruption of the normal flow of trade across the Atlantic during the war affected grain production not only in the exporting countries of the Western Hemisphere, whose European markets were lost, but also in Europe which found itself cut off from supplies of fertiliser and machinery. Moreover, in several European countries the destruction occasioned by military operations and the displacement of labour made it difficult to expand cultivated areas in order to compensate for the decline in yield per acre. Thus world production of wheat, maize, oats, barley and rye was down to 93% of the 1938 level in 1941 and 81% in 1945; by 1948, however, the comparable figure was 6% above the pre-war level.

Owing to pressure on shipping space the oversea movement of grain during the war was largely confined to wheat, since the available shipping was more economically used for livestock products than for feeding stuffs. Thus while imports of wheat into the United Kingdom, the principal importer, declined from 5 million tons in 1938 to about 3 million tons in the middle war years, those of feed grains fell from 4 million tons to only 100,000 tons. In North America, on the other hand, the increased demand for meat both for home consumption and for export to the United Kingdom, stimulated the production of grain for feeding to livestock and, since production in this area dominates the world total for feed grains, they did not show the same decline as bread grains. Moreover, when towards the end of the war it became clear that the demand for grain for liberated territories would be considerable, wheat production in North America was expanded also and after the end of the war very large quantities moved into export channels, Canada alone sending nearly 8 million tons in 1944 and nearly 9 million tons in the following year.

Canada was formerly the major wheat exporter but recently this position has been taken by the United States, whose exports of wheat in 1948 were well above twice those of Canada. Maize imports into the United Kingdom continued to come mainly from Argentina, despite the increase in United States production, though the quantity was much below the pre-war level. Moreover, the U.S.S.R. has re-entered the world grain market as an exporter on a considerable scale.

The Commonwealth is normally on balance an importer of grain, owing in the main to the heavy requirements of the United Kingdom. When these were much reduced in the later war years and Canadian exports were exceptionally large, there was a considerable export balance. Since 1946 the Commonwealth as a whole has again become an importer, but not on so heavy a scale as before the war, although India's import requirements have increased considerably.

Rice is shown to be a special case, for although production has regained the pre-war level the rise in population in Eastern countries has made an even higher level of production necessary to secure the same *per caput* consumption as before. Burma, Siam and Indo-China, the main exporting countries, have not been able to resume exports on the pre-war scale, owing largely to the needs of their own increased populations. Thus, although by 1947-48 world production was approaching the pre-war figure, exports in the latter year from the main exporting countries, at some 3,300,000 tons, were only 42% of the pre-war volume.

*' Grain Crops.' Published for the Commonwealth Economic Committee by H.M. Stationery Office, 1950, price 5s. net.

# Cocoa Production in South America

*In previous articles in 'World Crops' accounts have been given of the difficulties with which cocoa producers are confronted owing to the threat from disease. The chief cocoa producing areas are in West Africa and South America, and in both the ravages of disease are the principal factors influencing production. In this article, based upon a recent work, the position in the South American cocoa producing countries is discussed.*

THE outlook for the cocoa industry at the present time is, to say the least of it, precarious, mainly because of the prevalence of disease; in West Africa, Swollen Shoot and the capsid bugs Sahlbergella and Distaniella, and in the Western hemisphere the almost equally deadly, although perhaps less publicised, malady, Witch Broom disease or Escoba de Bruja.

West Africa at present accounts for well over half the world's cocoa supplies; of the remainder, the bulk, amounting on the average to 136,000 tons a year or one fifth of the world's exports, comes from South America, to which must be added an uncertain but not inconsiderable amount of cocoa which is consumed domestically in the continent of South America itself. The West African cocoa industry, however, is of comparatively recent growth and up to the early years of the present century South American cocoa held the predominating place.

It is curious that published accounts of the cocoa industries of the South American countries are so meagre, and on this account the appearance of a recent book,* 'Cacao Production of South America,' by a Swedish author, Ivar Ernholm, is to be welcomed. The compilation of the work entailed research and study in a number of countries during the four years 1945 to 1948, the cost of which was borne by the Swedish Association of Chocolate and Confectionery Manufacturers, the University of Gothenburg and other Swedish sources, in itself a somewhat remarkable fact.

The book is concerned with the history, development and present circumstances of cocoa production in the various South American countries. It contains a detailed account of the climatic and soil conditions in the producing regions and discusses economic and other factors which have contributed to the present position. It is well documented and contains numerous maps and diagrams.

**Cacao Production of South America* by Ivar Erneholm. Gothenburg, Sweden, 1948.

## Historical

Cocoa is, of course, a native of the western hemisphere, and its existence as a cultivated crop in the South and Central American regions extends back into the unprobed recesses of the distant past. It seems clear, for example, that the Mayas of Central America had an intimate knowledge of cocoa cultivation at the time of the Spanish conquest in 1519, as did also the Incas of Peru; extensive plantations of cocoa existed in the lower-lying areas throughout this Central American region and in some cases there seems to have been elaborate provision of canals and reservoirs for irrigating the crop. Cocoa and chocolate were important foods of the original Aztec and Maya populations of this region.

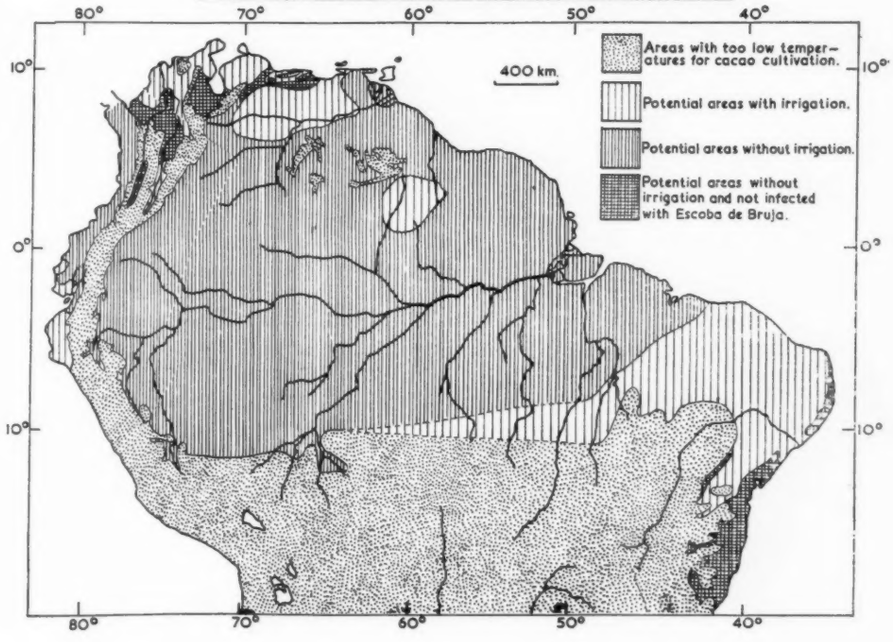
Under Spanish and Portuguese influence the commercial production of cocoa as an export crop in South American countries steadily developed and, until the early years of the present century, cocoa produced in the western hemisphere, including the West Indian islands, completely dominated the market.

## The present position

There are today three major cocoa-producing countries in South America—Brazil, Venezuela and Ecuador—and of these Brazil is by far the most important. The crop is, however, also grown in a number of other countries, *viz.* Bolivia, Peru, Colombia, and British, Dutch and French Guiana, but they no longer export.

The exports from the three principal

Potential areas of cacao cultivation in South America



producing countries for the eight years 1940 to 1947 inclusive are shown in the table, which is extracted from the book:

COCOA EXPORTS FROM THE THREE PRINCIPAL PRODUCING COUNTRIES IN S. AMERICA 1940-47
(in tons)

| | *Brazil* | *Ecuador* | *Venezuela* | *Total* |
|---|---|---|---|---|
| 1940 .. | 106,799 | 11,208 | 15,267 | 133,274 |
| 1941 .. | 132,944 | 14,433 | 12,866 | 160,213 |
| 1942 .. | 71,904 | 13,762 | 12,154 | 107,820 |
| 1943 .. | 115,120 | 18,161 | 14,951 | 148,232 |
| 1944 .. | 101,920 | 13,701 | 16,050 | 131,671 |
| 1945 .. | 83,434 | 16,827 | 12,393 | 112,654 |
| 1946 .. | 130,460 | 16,484 | 16,167 | 169,111 |
| 1947 .. | 99,041 | 20,251 | 11,945 | 131,237 |

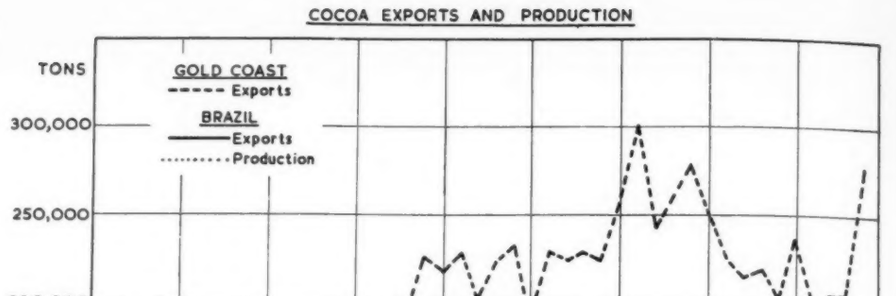
The position has changed considerably since the commencement of the present century. For the years 1900 to 1905, for example, the average exports from these three countries were:

| | *Tons* |
|---|---|
| Brazil .. .. .. | 20,783 |
| Ecuador .. .. .. | 24,234 |
| Venezuela .. .. | 10,3.6 |
| Total .. .. .. | 55,333 |

Moreover at that time a number of other South American countries which are now no longer exporters produced appreciable quantities of cocoa for export. Today South America would play a very subordinate part in the world's cocoa markets were it not that Brazilian production has increased so very greatly. This is due to the enormous increase in production in the Brazilian state of Bahia, which has risen from about 6,700 tons in 1895 to over 120,000 tons in 1946, paralleling in this respect the development of cocoa production in West Africa. The only other centre of production in Brazil is in the Amazon basin, where production is still relatively small, averaging about 4,000 tons per annum.

## Types grown

At the commencement of the century the bulk of the cocoa produced in South America was the high-quality and relatively high-priced criollo type. Since then, while Ecuador and Venezuela have continued to produce high-quality cocoa, there has been a great increase in the production of lower-grade, lower-priced cocoa of the forastero and amelonado types, centred on the one hand in West Africa and on the other in the state of Bahia of Brazil. Low prices have been one of the factors responsible for the change, the other has been the spread of disease; firstly, Monilia pod rot which first made its appearance in Ecuador in 1918 and, secondly, the much more serious Witch Broom disease, which appeared first about 1920 and has now spread throughout the greater part of the South American and West Indian area. Despite repeated reports to the contrary, it does not yet seem to have established itself in Bahia




and it is apparently this fact which has contributed mainly to the rapid development of the industry in that state.

## The development of cocoa in Bahia

The rapid development of cocoa production in Bahia as well as the general circumstances of the industry, present some analogies with the contemporary developments in West Africa. Prior to the 1890s Brazilian cocoa production was confined to the Amazon basin; one factor which contributed to the genesis of the industry in Bahia was the abolition of slavery in 1888 which led to a large emigration of liberated African slaves from the sugar estates of north-eastern Brazil, who opened up the empty lands of Bahia in small cocoa holdings. To this day small-scale cultivation is a characteristic of the region. The type of cocoa cultivated is the lower-grade forastero type, as contrasted with the finer criollo which formerly constituted the bulk of South American exports.

The cocoa-growing districts of Bahia lie between the parallels of latitude 12° and 15° S. The main area between 14° and 15° S. is concentrated in a narrow belt parallel with the coast to a depth not exceeding 70 miles and an elevation not above 1,000 ft. The rainfall ranges between 40 and 80 in. a year and is well distributed, while the temperature range is remarkably equable having regard to the latitude. Further inland, conditions become arid and it is considered that it is this dry belt which has protected the country so far from invasion by Witch Broom disease.

A comparison between the development of the industry in Bahia with that of the Gold Coast during the same period is of interest and is shown in the accompanying graph, which has been constructed from data given in the work and other sources. The general similarity of the two curves will be noticed.

## Influence of Witch Broom disease

The author states that the fear that Witch Broom disease might spread to Bahia is the reason why no rejuvenation of existing plantations has taken place there of late years. Low prices during the depression of the 1930s hit the industry hard and led to the foundation in 1931 of the Instituto de Cacao, the functions of which are to give financial help to cultivators, create more favourable market conditions, improve transport and storage and establish a cacao experimental station.

If Witch Broom disease spreads to Bahia and becomes firmly established there, the industry will almost certainly decline; consequently, the possibility of its introduction must be an ever-present threat.

Indeed, its eventual introduction to and subsequent spread in Bahia seems inevitable, if one may judge from occurrence elsewhere. For example, the fact that the disease was well known and its harmful effects widely understood did not suffice to prevent its introduction into Trinidad, which is separated from the mainland of South America by the sea, nor its later spread to the adjacent islands of Tobago and Grenada, notwithstanding that efficient agricultural services exist in all three places.

### The future of cocoa in S. America

The future of cocoa in South America and in fact throughout the whole of the western hemisphere is bound up with the control of Witch Broom disease. As the author of the work points out, the disease is not a serious menace under dry climatic conditions and, in various small areas in South America which possess dry climates and facilities for irrigation, cocoa is grown under irrigation without suffering from the disease. It may indeed be significant that in ancient times the original Maya inhabitants of Central America were wont to grow the crop under irrigated conditions. However, the areas where such conditions can be attained are limited, while in any event the installation of irrigation schemes is usually a difficult and costly business.

There are, it is true, still vast undeveloped areas in South America which possess soils and climatic conditions suited for cocoa in other respects but in which Witch Broom is endemic, including in particular the major part of the vast tract of the Amazon basin. At present, however, development is precluded by the threat of disease, although lack of population may to some extent be a further limiting factor.

The extent of the potential areas available for expansion, provided the disease threat could be removed, is shown in the sketch map on p. 249 which has been reproduced from the work under review.

### Possibility of controlling Witch Broom disease

The disease is caused by a fungus *Murasmius perniciosus* which infects the tree and causes its death. Its name is derived from the fructifications which appear on the stems of the trees and the pods. The ordinary methods of control by spraying and similar measures are ineffective against it, although some measure of control can be obtained by rigorous plant sanitation measures, including the immediate removal of all infected material and fructifications as soon as they appear. So far, the most promising method of control is the production of resistant or tolerant strains of cocoa. The work of the Cocoa Research Scheme at the Imperial College of Tropical Agriculture and of the staff of the Trinidad Department of Agriculture has shown that resistant strains exist, and a number have been collected, mainly by the late Dr. F. J. Pound, and propagated in the nurseries of the Department of Agriculture in Trinidad. The rehabilitation of the cocoa industry in Trinidad is now being undertaken by replanting with vegetatively propagated disease-resistant material. Work on these lines seems to hold out the greatest hope of success for the rehabilitation and development of cocoa cultivation in the South American region, but it cannot be gainsaid that it presents a formidable task, bearing in mind that, as in West Africa, much of the cocoa is grown on smallholdings by people of low educational attainments. Indeed it can be said as a generalisation that in South America, as in West Africa, the future of cocoa planting depends on the introduction of much better standards of maintenance than have been current in the past, coupled with the provision of the best scientific advice.

### Cultivation conditions

Apart from the disease problem it would seem that yields of cocoa are in general far too low throughout the South American region. The work of Cheesman and others at the Trinidad Cocoa Research scheme has shown how greatly yields can be raised by planting vegetatively propagated material from selected high-yielding clones, and the results of this are being applied in Trinidad. Little progress in a similar direction has apparently been recorded in the South American region so far, although it seems obvious that once the disease threat has been overcome it represents one of the most potent resources for improving yields. Moreover, the use of fertilisers is very restricted and little or no systematic data are available regarding the manurial requirements of the crop, while cultivation is often of a low standard.

### The need for research

In all these regards as well as in relation to disease control there is an obvious need for research on an extensive scale. The work of the recently established Inter-American Cocoa Research Centre at Turrialna in Costa Rica as well as that of the Instituto de Cacao in Brazil, and work in progress in Venezuela and elsewhere should be of assistance, while the investigations of the Cocoa Research Scheme in Trinidad, the resources of which have recently been considerably enlarged, should continue to provide invaluable indications of the lines along which progress is possible.

Nevertheless, if this provision is to bear effective fruit and the industry is to be freed from the threats which now assail it and its future assured, active measures seem also necessary to ensure that the results of research are effectively applied in practice. Here it must be admitted that so far as can be judged in South America, as in West Africa, existing conditions do not appear, for the most part, to be such as to make the prospects particularly reassuring. Indeed, one feels that in both regions wholesale and drastic reconstruction of the industry may be needed if production is to be safeguarded and the potentialities for expansion developed.

### Conclusion

It has only been possible to comment upon some of the more important points which emerge from a perusal of the book under review. It is, however, replete with information, some of which has not previously been presented in a conveniently accessible form. As such it forms a valuable addition to the literature of the cocoa industry.

H. TEMPANY

---

## DDT Emulsion Gives High Kill

In Arkotine D.15, Shell Chemicals Ltd. claim to have evolved a DDT emulsion which, while simple and economical to use, has a killing power far superior to normal emulsions of this type.

The new product contains 15% DDT (by weight) dissolved in an aromatic base oil with a special synergist which enhances the insecticidal value of DDT to a remarkable extent, and in tests, in which normal 15% and 20% DDT emulsions scored 24% and 36% kill respectively, Arkotine D.15 was credited with no less than 84% kill.

Incorporation of the synergist enables Arkotine D.15 to be applied at unusually low concentrations and it should therefore prove an economical product.

DDT in oil controls a wider range of pests and gives greater control of aphis than when incorporated in wettable powders or dusts and as the oil acts as a spreader and sticker resistant to rain the residual effect is prolonged.

Low or high volume equipment can be used for spraying Arkotine D.15, and in the main high volume equipment is only necessary for fruit plantations and aphis on ground crops.

Shell recommend that insect pests attacking vegetable and root crops be sprayed with Arkotine D.15 when first seen and it is claimed that, due to the prolonged residual effect, one spraying may give control of more than one pest in crops such as peas which are fairly regularly attacked by weevil, maggot and aphis each season.

Arkotine D.15 is also recommended for control of pollen beetle and mustard beetle in seed crops, of winter moth, codling moth and tortrix moth caterpillars, capsid, apple blossom weevil and aphis on fruit, as a cattle spray for other than dairy cows and for control of flies in farm buildings where it is claimed that, on a favourable surface, the residual effect will last for up to three months.

# The Problems of Selective Weed-killing

THE inaugural Fernhurst lecture, endowed by Plant Protection Ltd., was recently given at the Royal Society of Arts by Professor G. E. Blackman of Oxford University. The title of the lecture was 'Selective Toxicity and the Development of Selective Weed-killers,' a subject on which Professor Blackman is a leading authority.

The major developments of selective herbicides have practically all taken place in the last 10 years and at an ever-accelerating pace, until today the farmer stands amidst a volume of new techniques and highly complex chemical compounds, somewhat dazed by the speed of events in a proverbially slow-moving industry. As the lecturer observed, the situation is analogous to that of Alice in Wonderland—a region where anything may happen and probably will.

### Complications of research

Research at present is largely a process of trial and error and no key has yet been found to the workings of the selective mechanism. The permutations of the various affecting factors are tremendous—spray concentration, whether the growth-regulating substance is sprayed in solution or as an emulsion, high- and low-volume spraying, stage of development of the plant, penetrating powers of the spray and ability of the plant to transport the growth-regulating substance to the roots are examples of the factors affecting the performance of any potential selective herbicide and their variations are many. At present, new chemical compounds are being synthesised faster than scientists can fully discover their properties and usefulness as weed-killers; consequently there is a tremendous amount of research accumulating and it will continue to do so until the fundamental principles of toxic action are better understood.

As an example of the difficulties facing the scientist Professor Blackman mentioned the case of methyl-chloro-phenoxyacetic acid, which will kill yellow charlock (*Sinapis arvensis*) and not kill mature cocksfoot (*Dactylis glomerata*). Charlock is susceptible both in the germination and vegetative stages of growth, while cocksfoot passes from susceptibility to resistance as it grows older. Now, unless it is discovered just how the selective mechanism operates,

**The control of weeds in peas with dinitro-secondary butyl-phenol.** *In the foreground :* **Plot sprayed with the ammonium salt.** *In background :* **Unsprayed plot infested with charlock** (*Sinapis arvensis*)

new developments will eventually come to a standstill. The argument that one species is a dicotyledon (normally storing starch) and the other a monocotyledon (only storing starch in the seed) does not hold, because other dicotyledons, like corn marigold (*Chrysanthemum segetum*), behave in exactly the same manner as cocksfoot and are only susceptible in the germinating phase. Investigations on stage of development and variations in toxicity have not greatly advanced the understanding of toxic action, yet important results have been obtained by studies of the relationship between resistance and susceptibility of both weed species and crop. For example, with linseed and flax, if spraying is restricted to the most resistant phase of the crop good weed control can be obtained.

In testing the comparative toxicity of a group of compounds it is essential not to leave out any of the chemical series. With trichloro-phenoxyacetic acid, for example, if the three chlorine atoms are attached in the 2-4-5 position on the benzene ring, then the compound is highly toxic; but if one chlorine atom is moved from the 5 to the 6 position, then toxicity is very greatly reduced.

It is not enough to confine the tests to a single plant. For instance, it has been found in America that active trichloro-phenoxyacetic acid was more toxic to several wild currant species (important weeds in forests of white pine) than 2 : 4-dichloro-phenoxyacetic acid. On the other hand, when the same compounds were used on buckbrush the order of toxicity was completely the reverse.

### Stage of development

The plant's stage of development when sprayed may be the deciding factor on when or what to spray. In investigations of hoary pepperwort (*Cardaria* (*Lepidium*) *draba*) the effects of spraying sodium methyl - chloro - phenoxy - acetate and dichloro-phenoxyacetic acid were noted before the plants were in flower, when they were in full flower and in the autumn stubble, when new shoots were regenerating. It was found that at the earliest spraying sodium methyl-chloro-phenoxyacetate is more toxic than dichloro-phenoxyacetic acid; in the autumn this difference is accentuated. Yet if the plants are sprayed in full flower the position is reversed.

What are the physiological complications of this stage of development factor? The pre-flowering stage is when the leaf area is greatest and therefore the number of spray particles likely to be caught is greatest also. For growth regulators to reach the root they have to penetrate the leaves, become absorbed into the shoot and transported down to the root. It seems that the quantity retained by the shoot is not a controlling factor, because degree of kill does not go up steadily as degree of spray concentration is increased. If the critical factor is leaf area, then there should be a constant result when a high concentration is sprayed on a small leaf area and *vice versa*, but this is not the case. Root destruction is probably caused by transport from the shoot and not by root absorption of the growth-regulating substance through the soil; removal of the shoot was found very greatly to reduce the toxic effect of sodium methyl - chloro - phenoxyacetate. Failure of a growth-regulating substance to destroy a perennial may be because the shoot is killed so quickly and consequently the transport is interrupted before the growth-regulating substance reaches the root. If this is so, less toxic compounds might be more effective.

**Trial on the eradication of coppiced hazel prior to replanting with hardwoods.** *Left :* **Unsprayed area.** *Right :* **Plot sprayed with an oil emulsion containing a mixture of the n-butyl esters of dichloro- and trichloro-phenoxyacetic acids**

**The control of hoary pepperwort (*Cardaria draba*) with growth regulating substances DCPA and MCPA. General view of experiment one year after spraying**

**Control of charlock in oats was obtained by using 'Agroxone' powder at the rate of 2 cwt. per acre. Note the definite line of demarcation between the treated and untreated portions**

### Low-volume spraying

The advent of low-volume spraying is an example of practice outstripping research and, although there is little scientific information on the effects on plants of reducing the volume of spray used (and hence increasing the concentration), this type of spraying is becoming widely used in this country and the U.S.A. Instead of the whole surface of the plant being covered by the spray, foliage is peppered with individual spray particles and there is no run-off. Each particle is much more concentrated in low-volume spraying, but the overall effect may not necessarily be more toxic than that resulting from spraying with 100 gal. per acre. To obtain precise information on low-volume spraying it is necessary to combine varying volume rates with varying amounts of herbicide per acre to get probits of kill for each volume rate. Thus the toxicity of sodium methyl-chlorophenoxyacetate to white charlock (*Raphanus raphanistrum*) may be dependent on spray volume; if the effectiveness of a given quantity of herbicide applied in 100 gal. is taken as 1.0, then when volume is decreased to 33 gal. this efficiency is increased to 2.1. At 24 gal. the efficiency falls to 1.76, at 13 gal. to 1.07 and at 6 gal. to 1.41. Thus the intermediate volume rate has the best kill in this case. However, the growth-regulating substance may be most toxic at a low rate or a varying spray rate may have no effect at all. When spraying at low volume, the part of the plant where the droplet lodges may be important; for example, with linseed the retention of droplets in the leaf axils close to the apical bud causes the maximum injury. Apart from the pattern of spray retention, the efficiency of low-volume spraying will depend on the efficiency of translocation, which in turn will depend on transport not being interrupted by death of the areas in contact with the droplets.

### Solutions and emulsions

Marked increase in toxicity of herbicides has been achieved by using emulsified solutions. In the case of peas, the addition of oil increased the toxic action of nitro compounds, dinitro-ortho-cresol and dinitro-secondary butyl phenol tenfold and corresponding results were obtained for mustard. As the oil has no toxic properties its addition must cause increased efficiency of the toxic compounds by enabling better spray retention by the leaf or penetration into the shoot or both. Peas were found to retain three times as much oil emulsion as ordinary solution and there was no difference in the case of mustard. Thus the increased toxicity obtained by using emulsions was a question of retention and penetration with peas, but penetration alone with mustard. Thus the use of emulsions may not, strictly speaking, increase the toxicity of any herbicide, but by enabling a greater retention it is tantamount to increasing the concentration.

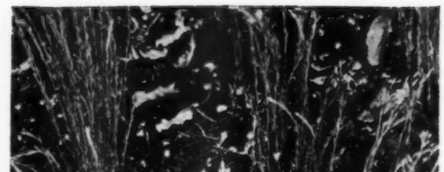
### Importance of variety

Experiments on different varieties of oats, using three different growth-regu-

lating substances and spraying at two stages (when the oats were about 9 in. high and at the shooting or ' boot ' stage), showed the complexity of varietal susceptibility and resistance. For instance, sodium dichlorophenoxyacetate did not affect appreciably one variety of oats at either spraying, whereas it halved the yield of another variety at the first spraying, while not affecting it at the second. When these two varieties were treated with sodium methyl-chloro-phenoxyacetate the relative losses in yield due to both sprayings were of the same order.

### Acquired resistance

Although there is no proof that resistance to toxic substances is an inherited factor in cereals, there is experimental evidence that this is so with linseed and resistance can be increased by mass selection. Plots of the variety Royal were subjected to very heavy applications of growth-regulating substances and seed was collected from the surviving plants. This seed was then compared the following year with seed from plants which had not been treated. The populations from the two types of seed were sprayed with doses of the phenoxyacetic acids and eventually harvested. There was no doubt that the selected seed had an appreciably increased resistance.



**Control of charlock in linseed Royal obtained from application of 'Agroxone' (Methyl-chlorophenoxy-acetic acid) at rate of 1 gal. of 'Agroxone' to 32 gal. of water**

*[Photos: p. 252 and the top two p. 253: Dept. of Agriculture, Oxford, bottom p. 253 and p. 254: Plant Protection, Ltd.*

If crop resistance can be achieved, so can weed resistance, and already in California continued spraying of roadsides with mineral oils has resulted in oil-resistant umbelliferous weeds replacing the original vegetation. As the number of herbicides on the market increases the prudent farmer will practise their rotation in the same way as he practises rotation of crops.

Today selective weed control is no longer practised solely on cereals and the range of applications has extended to maize, rice, sugar cane, linseed, flax, peas, lucerne, onions, carrots and grassland; in addition, developments are taking place for dealing with aquatic weeds in rivers and irrigation channels, for weed eradication in forest nursery beds and for the destruction of scrub.

The practical applications of selective weed-killers are increasing at a rapid pace, while the fundamental principles of toxic action remain to be fully understood.

# Crop Costing

***How profitable are my various crops? Is my labour organisation as efficient as it could be? Is one department of the farm being maintained by profits from the others? These are questions to which farmers would like to have the answer with certainty and yet so many have little or no idea at all. In these days when it is so important both from the nation's and the farmers' own points of view that full value should be obtained from all expenditure, it is regrettable that even now relatively few employ some system of costing. Unfortunately, the very word ' costing,' with its associations with the intricacies of book-keeping and the higher mathematics of accountancy, is liable to discourage many. There are, however, methods of costing crops which are not difficult to carry out and do not require a lot of time and from the results of which observations can be drawn to benefit the farmer in every case. The following article describes such a method.***

IN its simplest form crop costing means ascertaining as accurately as possible the actual amount of money spent, both directly and indirectly, to grow, harvest and dispose of a crop and also the return, both directly and indirectly, that the crop gives to the farmer. The final figure to be arrived at is the net profit or loss—generally on a ' per acre ' basis. Full benefit from the figures can be obtained only when a number of fields of one or different farms are costed, so that average figures can be worked out and the individual is able to compare his own results with the average. That is why the majority of crop costings are carried out from a centre—often a University Department of Agriculture—and samples of perhaps 50 fields of one crop are taken. Nevertheless, comparisons of costs from fields on one farm only can show interesting results and have real practical value.

Records need not be drawn up every year. A continuous record of all crops would require a system of full cost accounts. The method described here is intended for occasional use on crops in which the grower is particularly interested. Before starting to keep a record of the actual operations performed on a crop certain preliminary data have to be collected, for if the costs are going to be in terms of man-hours, tractor-hours and horse-hours, the farmer must know how much one hour's work is costing him.

Although the examples given in this article refer primarily to British-type farming, the principles are the same for farming conditions throughout the world. Units of power may be mules, oxen or even elephants but their costs can be worked out by exactly the same method as for horses given below. Similarly, manual labour may be obtained in divers forms, from coolies in Malaya to casual seasonal workers in

California, but the basic idea is just the same—that is, to include both direct and indirect payments in the total cost per year and work out the final figure in money value for each individual working on the crop.

### Horse and tractor costs

The comparative costs of maintenance of horses and tractors have been investigated by agricultural economists and others time and again, and set average costs per hour have been worked out; but because of the changing and generally rising costs of foodstuffs and fuel it is more satisfactory to work out the costs for the particular horses and tractors concerned, using the actual prices that are being paid for food, fuel, repairs, etc.

The cost of keeping a horse for a year is estimated in the following way:—*

| | £ |
|---|---|
| Oats, 1¾ tons at £12 .. .. | 21 |
| Hay, 2 tons at £5 .. .. | 10 |
| Pasture .. .. .. .. | 2 |
| Depreciation of horse .. .. | 7 |
| Attendance .. .. .. .. | 12 |
| Blacksmith and harness repairs .. | 8 |
| Veterinary and miscellaneous .. | 3 |
| | £63 |

Oats and hay are priced at the approximate cost of production, unless of course they are purchased, in which case the actual prices paid are used. Cost of attendance assumes that a horseman receives £1 per week extra for feeding and looking after four or five horses.

Having calculated the cost for a year, the farmer must decide how many days in the year the horse is working; if it works for an average of 2½ full days each week or 1,000 hours per year then the cost per hour is 1s. 3d. The more the horse is worked the cheaper is its hourly cost and *vice versa*.

This figure does not include any charge for implement depreciation and it is convenient at this point to add a small charge for implements and in the example above 3d. per hour might be considered a fair cost under average conditions. Thus it is reasonable to assume that the cost of a horse and its implements per hour in England is not less than 1s. 6d. today.

Tractors are costed in the same way; a standard wheeled tractor might show the following costs for a year:—

| | £ |
|---|---|
| Paraffin, 1,000 gal. at 1s. .. .. | 50 |
| Petrol, 70 gal. at 2s. .. .. | 7 |
| Oil, 60 gal. at 5s. .. .. .. | 15 |
| Repairs .. .. .. .. | 24 |
| Depreciation .. .. .. | 48 |
| Time spent on greasing and minor adjustments .. .. .. | 6 |
| | £150 |

Working for 2½ full days a week or 1,000 hours per year the cost per hour would be 3s. To this figure must be added a charge for implement upkeep and as tractor-drawn implements are generally more expensive than horse-drawn ones (renewal of ploughshares, etc.) a further 1s. may be added to the cost, making a total charge for tractor-hours in this case of 4s. It should be remembered that the hours worked by a tractor are very variable. Thus in individual cases costs per tractor-hour might be substantially greater or less than those shown above. Nevertheless, it would be reasonable to assume under average conditions that a medium four-wheeled tractor would cost 4s., a heavy-wheeled tractor 4s. 6d. and a tracklayer 6s. per hour, including ordinary cultivation implements.

### Extra machinery charges

Although an additional charge is made for implements, some are so costly that this figure does not cover their upkeep and extra charges are therefore made when they are used. Rates for additional machinery used, based on investigations, are: 1s. 6d. per hour for elevators, 2s. 6d. per hour for threshing drums owned by the farmer, 3s. per hour for binders and 21s. per hour for combine harvestors (12 ft self-propelled). These figures are arrived at by dividing the depreciation of the machine for the particular year in question, the cost of fuel and the cost of repairs by the approximate number of hours worked during the year. Depreciation rates vary according to the type of machine and the following list gives some idea of the different rates used:

| | In the £ |
|---|---|
| Steam boilers, engines, portable steam engines, threshing machines and fixed plant .. .. .. | 5% or 1s. |
| Petrol- or oil-driven tractors | 22½% or 4s. 6d. |
| Binders, reapers and combine harvestors .. .. | 15% of 3s. |
| Motor cars (the allowance is restricted to the proportionate part applicable to the use of the car for farming purposes) .. .. | 20% or 4s. |
| Sprayers and flax-pulling machines .. .. .. | 25% or 5s. |

### Manual labour

The cost of labour varies from man to man unless each receives exactly the same wage.

Usually, however, tractor drivers receive more than the minimum rate, foremen have their own separate wages, boys are paid varying amounts and so on. To the basic pay must be added the values of any perquisites received, the employer's National Health contributions, bonuses, overtime and allowances for holidays and sickness. Thus a man may receive £5 5s. 0d. a week or £273 a year; on top of this figure his employer may pay £10 for National Health, give him one ton of potatoes and 100 gal. of milk, together valued at £20, making a total of £303. Allowing for annual and statute holidays of three weeks and one week's sickness the man actually works for 48 weeks of 47 hours each or a total of 2,256 hours. The hourly cost of this particular man is therefore £303 divided by 2,256, or 2s. 8d. For the purpose of costing, family labour is charged at the current rate for hired labour.

### Cultivations

Having estimated the approximate costs per hour for manual and mechanical labour, the costs of cultivation operations can be found. For example, if a man takes four days to tractor-plough a 20 acre field, the cost per acre can be found if his hourly cost and that of the tractor are known. Let us assume they are 2s. 6d. and 4s. per hour; then the team costs 6s. 6d. per hour:

| | s. | d. |
|---|---|---|
| Cost for 4 days (32 hours) 6s. 6d. × 32 | = 208 | 0 |
| Cost per acre $\frac{208}{20}$ | = 10 | 5 |

Alternatively, by using a team composed of a 2s. an hour man and two horses charged at 1s. 6d. each, the cost of the team would be 5s. per hour, but the job would take longer, say 6½ days or 52 hours:

| | | | |
|---|---|---|---|
| Cost for 6½ days (52 hours) 5s. × 52 | = 260 | 0 |
| Cost per acre $\frac{260}{20}$ | = 13 | 0 |

All the cultivations of a crop may be estimated in this fashion. For a corn crop the following operations might be costed: Ploughing, muck carting and spreading, cultivating, harrowing, rolling, drilling, fertiliser distributing, carting seed and manure.

Besides the costs of cultivations those of the seed and fertiliser must be added. Farmyard manure is also included and investigations have shown that its manurial value is about 10s. per ton and the cost of spreading is also about 10s. per ton. The total cost of one ton spread is therefore 20s., and of this 10s. is carried forward to following crops as residual value, so it is charged for practical purposes at 10s. per ton.

Quite often some of the work carried out on a crop is done by a contractor who

* These figures are based on data given in *Farm Accountancy and Management*, by Ford Sturrock.

will carry out a certain operation for a fixed charge. In such a case the costing is simple and the charge per acre is the cost per acre to the farmer. Such operations as deep ploughing, gang weeding, spraying, chopping out and singling sugar beet are commonly done on a contract basis.

### Harvesting costs

There are often 'extras' in the harvesting operations of most crops which must not be overlooked. Clearing up the field is a small job, but it still costs money. Casual labour may be employed; threshing is sometimes done by a contractor, using partly the farmer's regular labour and partly his own, and usually employing the farmer's tractor as the power unit. Miscellaneous charges like binder twine, thatching straw, thatching pegs and baskets for potato picking are relatively small items but, even so, they help to make the final figures as accurate as possible when they are included.

### Rent and overheads

When the cultivation and harvesting costs have been assessed there are two more items to be added before the total cost is arrived at (residual values of manures will be dealt with in a later section). They are the rent and overheads, the former being fairly straightforward and the latter extremely difficult to find accurately. In the case of the farmer who owns his land a charge should still be made for its rental value as this is equivalent to a charge on capital. Sometimes extra charges are made on certain lands by public or semi-public bodies, such as catchment boards, who provide a service by keeping the land drained, and these extra charges must not be forgotten.

Overhead expenses include costs which cannot be allocated to any particular crop and they should therefore be spread over the whole acreage equally. Hedging, ditching, odd jobs which cannot be allocated to one crop, and management charges are all overhead expenses and there are various methods of finding them. The only really satisfactory way is to have a complete set of costings for the whole farm so that the exact amount of overhead expenses can be seen, but this is a big task and most farmers are not prepared to go to that length. One method is to make an allowance based on the amount of labour used. In this way root crops, which require a large amount of hand labour, would be charged a greater sum per acre than cereal crops. A more satisfactory method is to make an allowance for overheads based on the total costs of cultivating and harvesting; 10% of this figure should be enough to cover overheads on a farm of not more than 300 acres on medium or light soil, having no office or purely managerial staff. On heavy land overhead expenses tend to be high through loss of time during weather un-

COST OF PRODUCTION OF 20 ACRES OF BARLEY

TOTAL COSTS

Crop ..... Barley
Variety ..... Spratt Archer.
Field ..... Spinney.
Acreage ..... 20.
Season ..... 1948-49

| Operation, etc. | 2/6 M | 2/3 M | 2/- M | 1/9 B | 1/6 H | 5/9 T1 | 4/- T2 | 3/- T3 | Hours Taken | Total Cost £ s. d. | Cost Per Acre £ s. d. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ploughing .. | 1 | | | | | 1 | | | 40 | 16 10 0 | 16 6 |
| Cultivating (twice) | | 1 | | | | | 1 | | 32 | 10 0 0 | 10 0 |
| Harrowing .. | | 1 | | | | | 1 | | 12 | 3 15 0 | 3 9 |
| Mixing fertilisers | | | 1 | 1 | | | | | 4 | 1 5 0 | 9 |
| Carting fertilisers | | | 1 | 1 | | | | | 3 | 15 9 | 10 |
| Distributing fertilisers .. | | 1 | | 1 | | | 1 | | 16 | 6 8 0 | 6 5 |
| Harrowing .. | | | 1 | | 1 | | | | 16 | 2 16 0 | 2 10 |
| Carting and drilling .. | | 1 | | 1 | | | 1 | | 16 | 6 8 0 | 6 5 |
| Rolling .. .. | | | 1 | | 1 | | | | 20 | 3 10 0 | 3 6 |
| Spraying .. | Whole job done by contract at 63s. per acre | | | | | | | | | 63 0 0 | 3 3 0 |
| Opening up field | | 1 | 1 | | | | | | 8 | 1 14 0 | 1 8 |
| Cutting by binder | 1 | | | | | | 1 | | 22 | 7 5 0 | 7 3 |
| Stooking .. | | 2 | 2 | 1 | | | | | 16 | 8 4 0 | 8 2 |
| | | | | | | | | | binder | 3 6 0 | 3 4 |
| Carting and stacking .. | 1 | 2 | 1 | 1 | | | 1 | 1 | 24 | 18 16 4 | 18 10 |
| Thatching .. | | | 1 | 1 | | | | | 24 | 4 10 0 | 4 6 |
| Clearing up field | | 1 | | 1 | | | | 1 | 6 | 2 2 0 | 2 1 |
| Threshing .. | 1 | 3 | 1 | 1 | | | 1 | | 12 | 10 4 0 | 10 2 |
| Total cost of manual, horse and tractor labour .. .. .. | | | | | | | | | | 169 19 1 | 8 10 0 |
| Rent, at 30s. per acre .. .. .. .. .. .. .. | | | | | | | | | | 30 0 0 | 1 10 0 |
| Seed, 3 bushels per acre—7½ qr. at 100s. .. .. .. .. | | | | | | | | | | 37 10 0 | 1 17 6 |
| Miscellaneous | | | | | | | | | | | |
| Binder twine .. .. .. .. .. .. .. .. | | | | | | | | | | 5 0 0 | 5 0 |
| Thatching straw and pegs, 2 tons straw at £3; pegs, 12s. .. .. | | | | | | | | | | 3 12 0 | 3 7 |
| Threshing, hire of tackle plus two men at 30s. per hour .. .. | | | | | | | | | | 18 0 0 | 18 0 |
| Manures: | | | | | | | | | | | |
| 1 ton sulphate/ammonia at £10 15s. 0d. .. .. .. .. | | | | | | | | | | 10 15 0 | 10 7 |
| 3 tons superphosphate at £6 6s. 0d. .. .. .. .. .. | | | | | | | | | | 18 18 0 | 18 11 |
| 1 ton muriate/potash at £18 15s. 0d. .. .. .. .. .. | | | | | | | | | | 18 15 0 | 18 9 |
| | | | | | | | | | | 312 9 1 | 15 12 5 |
| Add 10% for overheads .. .. .. .. .. .. | | | | | | | | | | 31 4 11 | 1 11 3 |
| | | | | | | | | | | 343 14 0 | 17 3 8 |
| Add manurial residues brought forward .. .. .. .. | | | | | | | | | | 41 12 0 | 2 1 7 |
| | | | | | | | | | | 385 6 0 | 19 5 3 |
| Deduct manurial residues carried forward: | | | | | | | | | £ s. d. | | |
| 1 ton sulphate/ammonia .. .. .. .. | | | | | | | | | Nil | | |
| 3 tons superphosphate .. .. .. .. | | | | | | | | | 10 16 0 | 14 11 0 | 14 6 |
| 1 ton muriate/potash .. .. .. .. .. | | | | | | | | | 3 15 0 | | |
| NET COST .. .. .. .. .. .. .. .. | | | | | | | | | | 370 15 0 | 18 10 9 |

TOTAL RECEIPTS AND NET PROFIT

| Receipts, etc. | Total £ s. d. | Receipts Per Acre £ s. d. |
|---|---|---|
| (Total yield—100 qrs. or 5 qrs. per acre.) | | |
| 90 qrs. sold at 103s. a qr. .. .. .. .. .. .. | 463 10 0 | 23 3 6 |
| 10 qrs. kept—valued at 60s. a qr. .. .. .. .. .. | 30 0 0 | 1 10 0 |
| Total Receipts .. .. .. .. .. .. .. .. | 493 10 0 | 24 13 6 |
| Total Costs .. .. .. .. .. .. .. .. | 370 15 0 | 18 10 9 |
| Net Profit .. .. .. .. .. .. .. .. | 122 15 0 | 6 3 9 |

M .. .. Man.
B .. .. Boy.
H .. .. Horse.
T .. .. Tractor.

1—Including 6 hours overtime at 2s. 10d., and a charge of 3s. an hour for the binder.
2—Casual labour at 2s. an hour.
3—Including 4 hours overtime.

**An example of a complete costing of a field of barley**

favourable for cultivation and through higher drainage and ditching costs. Here 12½% is a better allowance. Very large farms with heavy management expenses may find that overheads should be charged against the crop at 15% or even 20% of the cost.

### Residual values

Dressings of farmyard manure and fertilisers not only benefit the crop for which they are intended but their benefits are felt by succeeding crops as well. Therefore not all the cost of manure applied can be charged to the crop which is being costed, and a certain amount must be deducted and carried forward. Similarly residual values from previous crops in the particular field must be credited to the crop in question. The Ministry of Agriculture has published scales for residual values* which are the standards used by agricultural valuers and the table below shows a suggested list of prices to be allowed per ton of manure.

As an example, the residual values per acre of a possible dressing are given here:

| | £ s. d. |
|---|---|
| 8 tons farmyard manure .. .. | 4 0 0 |
| 3 cwt. sulphate of ammonia .. | — — — |
| 2 cwt. superphosphate .. .. | 7 2 |
| 1 cwt. muriate of potash .. .. | 7 6 |
| Total to be carried forward .. | £4 14 8 |

### Receipts

Working out receipts is fairly straightforward. The quantity sold and price received are known and the total value is merely a matter of multiplication.

* *J. of Min. of Agr.*, July 1946.

Costs are best calculated on a 'field gate' basis, which includes all costs up to the point of leaving the farm; any beyond that point are deductions from receipts. However, there are one or two points to be remembered. Firstly, there is often a charge for carriage, particularly with sugar beet, and this must be deducted from the receipts. Secondly, if part of the crop is kept, such as is often the case with corn, it must still be credited and the valuation figure used is the cost of production. Tail corn is credited at a lower rate than head corn. Thirdly, there is the question of by-products such as straw and sugar beet tops. If they are sold then the price received must be credited to the crop. If straw is used for feeding or litter a nominal value may be deducted from the costs. Sugar beet tops, when ploughed in are credited at their manurial value of 3s. 6d. per ton.* The feeding value of tops is given as 35s. per ton by the official index of feeding values, but as a large proportion are soiled and lost they are valued at 16s. per ton if folded by stock in the field; a further 4s. per ton is deducted if the tops are carted off the field for feeding elsewhere. Finally any subsidy or acreage payment must not be overlooked and is to be credited to the receipts.

### Interpretation of results

Having arrived at the final figure of net profit or loss per acre the farmer can see how his money has been spent in producing his crop and if he has comparable figures from other fields and farms, can see where his costs are on the high side and then introduce different methods of operation to reduce them.

* Based on data published in *The Journal of the Royal Society of England*, Vol. 96, p. 148.

Unlike enterprise costs for dairy cows and pigs, exact standards for crops costings cannot be laid down, as the costs of cultivation vary according to circumstances. Nevertheless, crop costings are of value in drawing up standard values for book-keeping purposes. They can be used for comparing the costs of producing home-grown foodstuffs with those of purchased feeding stuffs, and ascertaining which is the cheaper method of feeding stock. They can be used in conjunction with livestock costing schemes when the crop is grown for fodder.

When the costing is one of many, as in a scheme organised from a central organisation, the farmer can see where his practices differ from those of the most profitable farmers; perhaps too much expensive seed is being used when a small seed rate would give as good results; sometimes harvesting routine is found to be unwieldy and wasteful of manpower and a more efficient routine could be introduced.

When records are kept over a number of years they afford further opportunities for learning through experience, and seasons of similar weather conditions can be compared to find out which methods are best for the prevailing conditions. Above all, crop costings enable the farmer to see exactly how his money is spent and that is a revelation which many have not witnessed.

R.G.P.

#### BIBLIOGRAPHY

F. Sturrock, B.SC.: *Farm Accountancy and Management*, Pitman (2nd Ed., 1950).

The information for this article is based on methods used by the Farm Economics Branch of Cambridge University and from the writer's experience of costing crops for that Department. Any opinions expressed do not necessarily reflect those of the Farm Economics Branch.

RESIDUAL VALUES PER TON OF MANURE APPLIED

| Type of Fertiliser | Deduct Value Carried Forward to Subsequent Crops | Add Value Brought Forward for Manures Applied* | | |
|---|---|---|---|---|
| | | Previous Year | Two Years' Previous | Three Years' Previous |
| | £ s. d. | £ s. d. | £ s. d. | £ s. d. |
| Superphosphate (18% $P_2O_5$) .. | 3 12 0 | 1 16 0 | 18 0 | 18 0 |
| Triple supers (48% $P_2O_5$) .. | 9 12 0 | 4 16 0 | 2 8 0 | 2 8 0 |
| Basic slag (medium grade) .. | 1 16 0 | 18 0 | 9 0 | 9 0 |
| Muriate of potash (60% $K_2O$) .. | 7 10 0 | 3 15 0 | 3 15 0 | Nil |
| Sulphate of potash (48% $K_2O$) .. | 6 0 0 | 3 0 0 | 3 0 0 | Nil |
| Sulphate of ammonia, nitrate of soda .. .. .. .. | Nil | Nil | Nil | Nil |
| National compounds: | | | | |
| No. 1 .. .. .. .. | 2 17 0 | 1 9 0 | 1 1 0 | 7 0 |
| No. 2 .. .. .. .. | 2 0 0 | 1 0 0 | 13 0 | 7 0 |
| No. 3 .. .. .. .. | 2 10 0 | 1 5 0 | 13 0 | 12 0 |
| Concentrated compound for: | | | | |
| Sugar beet (14% N, 16½% sol. $P_2O_5$, 10% $K_2O$) .. .. | 4 11 0 | 2 5 0 | 1 10 0 | 16 0 |
| Potatoes (12% N, 12% sol. $P_2O_5$, 15% $K_2O$) .. .. .. | 4 6 0 | 2 3 0 | 1 11 0 | 12 0 |
| Lime .. .. .. .. | ⅛ of cost | ⅛ of cost | each year | for 8 years |
| Farmyard manure .. .. | 10 0 | 5 0 | 3 0 | 2 0 |

Adapted (except for F.Y.M.) from the recommendations of the Committee appointed by the Ministry of Agriculture (for further details see *J. of Min. of Agr.*, July 1946). Unit values assumed are N—10s; $P_2O_5$—6s.; $K_2O$—5s.

* These are the net amounts chargeable to a crop; allowance has been made for the proportion chargeable to subsequent crops.

## Canadians Asked to Increase Linseed

Members of Canada's Barley and Oilseeds Conference were told that a linseed (flaxseed) campaign is a definite necessity for the future welfare of the industry, and that the idea of growing at least some linseed every year must continue to be impressed upon Canadian farmers. In 1949 Prairie Province plantings amounted to 303,500 acres and Canada's total acreage was only 321,100.

It was pointed out that there was a good outlet for all oilseeds in Canada and that 200 million lb. of edible oils were manufactured in 1949.

In addition to linseed, Canada is now producing soya beans, sunflower seed and rape seed.

# Egyptian Agriculture

PROSPERITY of agriculture in Egypt finds its response in the life of almost every one of its inhabitants and the latest (1947) census showed that 68% of the total population were registered as agriculturalists. The industrial growth of Egypt will probably deprive agriculture of the cheap hand-labour it is now able to procure, but, on the other hand, the use of modern machinery in farming will find a greater support than it now obtains; and agriculture in general will be more prosperous as a result of an increased home consumption of the raw materials produced by the land and utilised by the new industries.

*The ancient Egyptian civilisation is associated with the earliest methodical developments of agriculture in a land gifted with a rich soil, an ample supply of irrigation water and a congenial climate. Today agriculture is the main pursuit of the Egyptian people, and an account of present-day conditions and practices is given in this article.*

## Cultivated areas and land-ownership

With the exception of the district of Fayyum, which is, practically speaking, a big oasis in the Libyan desert watered from the Nile, the whole cultivated area consists chiefly of narrow strips of land along the River Nile, and of the broader Delta tracts. The cultivated area for the year 1947-48 amounted to 5,822,000 feddans,* or roughly one thirtieth of the total area of the Egyptian Kingdom, the rest being mainly desert. With the completion of irrigational and drainage projects, the above area is estimated to exceed 7,000,000 feddans. Two crops a year are taken from the same area where perennial irrigation is available. For this reason, the area of crops in 1946-47 amounted to 9,151,000 feddans. Generally, cotton takes up 30% of the area in question unless restricted by law to a certain percentage.

Pre-war areas under wheat constituted 24% of the total area. This percentage rose to 28% in consequence of legislation promulgated for the increase of foodstuffs. Areas under maize and millet had been 32% and rose to 43%, also in consequence of this legislation. Areas under rice are determined by the amount of water supply available. Consequently, they might diminish to 3% or increase to over 13%, as the case may be. Other main crops are beans, barley, sugar cane and onions; they occupy smaller areas, as compared with the foregoing crops. The small farmers of five feddans each or less own about 34% of the total taxed area. This class of farmer is protected by law against the expropriation of their lands. An equal area is possessed by a middle class of farmers each possessing over 5 and up to 50 feddans, leaving about 36% for the big landowners of over 50 feddans each. The Islamic law of inheritance, which is also followed by the Christian Egyptians, and the numerous progeny of the common farmer in Egypt, brings about the continuous splitting of possessions and the predominance of small holdings.

*1 feddan = 1·04 acres.

**The Egyptian scene. Fields with the pyramids in the background**

**These fields are flooded as a result of the river overflowing its banks—a common occurrence in Egypt**

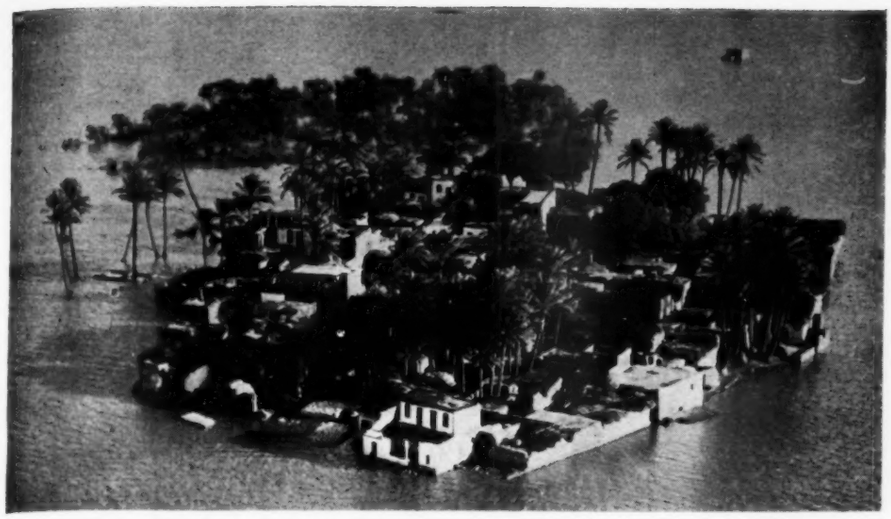
## Egyptian soil and fertilisers

The soil of Egypt owes its formation to the River Nile. The Abyssinian tributaries of this great river have steep beds, as they flow from high mountainous ground. The water, therefore, runs at a great speed and brings down with it earthy matter from the mountain sides. Many of the mountains in this region are extinguished volcanoes, and the waste matter formed from them is very rich in ingredients necessary for fertile soils. The thickness of the layer of Nile mud in Egyptian soils is as much as 18 metres in places.

Egyptian soils might have been classed as heavy and impermeable in humid weather. But the hot sun of Egypt dries the earth satisfactorily, and deep and wide cracks are formed, permitting the penetration of the air deep into the soil, thus stimulating the life of the soil bacteria, improving its physio-chemical properties and aiding the formation of available plant nutrients.

Physically, the soil is more or less loamy. The particles deposited from the Nile water vary in size with the variation of the velocity of the current carrying them. Hence, nearer to the river is usually found a lighter soil, as the finer clayey particles are carried farther away until the current becomes weak and therefore unable to hold them. The sand of the desert mingles with the soil in certain places, and predominates in the vicinity of the desert. Clayey soils occur in small patches.

From the chemical point of view, Egyptian soil is generally rich in lime and potash, but rather poor in organic matter. Farmyard manure is therefore very useful, but unfortunately only limited quantities are available, as the number of farm animals is relatively small owing to lack of permanent pastures. The available quantities of this manure are generally reserved for the maize crop, which is the main food of the small farmer. Other organic manures are used in vegetable and fruit growing. Nitrogenous fertilisers are consequently in great demand in Egypt.



**This village is completely surrounded by flood water from the Nile**

*[Photos: Egyptian Education Bureau*

The amount of nitrogen added to the soil in the form of fertilisers comes to an average of 5 kg. per feddan. Only three European countries show a higher consumption of nitrogen. The enrichment of the soil in nitrogen is also attained by the growing of the leguminous plant, berseem (Egyptian clover), which annually covers almost 30% of the total cultivated area, in addition to a temporary crop grown in the areas intended to be sown in cotton.

On approaching the coast of the Mediterranean, the water-table rises nearer to, or higher than, the surface of the soil. Along the coast is a number of salt lakes which, with their marginal swamps, cover about a million feddans. Lake Abukir, the smallest of the group, was drained and reclaimed into cultivable land. A number of estates in this salty region were also reclaimed by the government, various land companies and individuals. A vast area, however, is still lying waste and the greater part is in the possession of the government. The work of reclamation requires primarily the removal of noxious salts by proper drainage. The most prevalent salts in these lands are common salt and, to a lesser extent, sodium sulphate. In the interior of the country salty areas also exist, as a result of an artificially raised water-table due to filtration from a canal or higher neighbouring fields.

In Egypt there are no acid soils. The Egyptian soil gives generally a slight alkaline reaction. When alkalinity exceeds a certain limit, the soil becomes intolerable to plant growth. True alkaline soils are not very common in Egypt, but the ordinary salty lands already referred to are liable to become partly alkaline during the process of washing out their salt contents. The most common salts causing alkalinity are sodium carbonates and bicarbonates. The addition of gypsum has been found to be a useful remedy for such soils. Strange to say, some alkaline areas have been found to contain naturally a certain amount of gypsum, and no explanation has yet been found for their continued alkalinity.

## Agricultural seasons and crop rotations

The Egyptian farmer follows the Coptic calendar in reckoning the date for his various agricultural operations. This is because this calendar is the oldest in use in the country, and its use is associated with sayings and traditions related to the flow of the Nile, the climatic changes, the times of sowing or harvest, etc. The agricultural year contains three seasons. November is generally the month for starting new land leases. It is also, roughly, the beginning of the winter season, when crops like berseem, cereals, onions, beans, lentils, flax, lupins, chick-peas and a few other minor crops are sown. The summer crops are sown in February or a little earlier, and may continue to be sown until May. They include cotton, rice, sugar cane, millet, earthnuts, sesame and a few others. The third season is called the ' Nili ' or flood season. It falls in July and August, when maize is mainly grown.

In Lower Egypt and the greater area of Upper Egypt, cotton is the main crop in the agricultural cycle. It is generally grown on the same land once every two or three years, usually preceded by a catch crop of berseem. In the two years' rotation it occupies half the area of the farm, the other half being given to cereals (wheat and barley) and leguminous crops (berseem and beans), which are followed by a ' Nili ' crop of maize or a fallow.

In the three-year cycle, cotton occupies only one third of the area of the farm. It is superseded in the second year by the leguminous crops plus maize, and in the third year by cereals plus maize. In certain districts of Upper Egypt, sugar cane is a predominant crop. The rotation, therefore, resembles that of the three-year cycle already quoted with sugar cane in place of cotton. However, as the sugar cane is rationed to give a crop the next year, the rotation becomes a four-year one. Various other rotations are followed to suit conditions of soil and climate. In the sandy areas, for instance, earthnuts, sesame and henna (*Lawsonia*) occupy an important place in the cycle.

## Cultivation

Before the reign of Mohammed Ali the cultivated land was divided by embankments into basins of various dimensions, which used to be inundated with Nile water in the flood season to a depth of 3 to 6 ft. The water was then allowed to escape to the falling river. A thick layer of Nile silt was deposited on the surface of the land, and it required very little effort to sow the winter crops, other crops being uncultivated except in places which could raise water in summer time from the Nile or its branches. In some cases, the seed was simply scattered on the wet soil without previous tillage, and a light ploughing followed to cover the seed. The plough used, which is still in common use, is a simple primitive implement, which stirs the soil to a depth of 15 to 18 cm. but does not turn it over.

When Mohammed Ali introduced cotton growing, he found it necessary for the extension of this crop to devise methods for providing repeated waterings. He started digging canals and the erection of the Delta Barrage, to regulate the flow of the water at a convenient level. The old system of basin irrigation gradually gave way to what is termed perennial irrigation. The basin system is still followed in about 947,000 feddans. Under the perennial system of irrigation the land grows two or three crops a year, but in the meantime requires artificial drainage and proper tillage and manuring. The winter crops are generally grown on the flat, in very much the same way as in the basin lands. They, however, generally get a preceding ploughing, and are given about two waterings or more during their growth.

The summer crops generally require greater attention than winter crops. Generally two or three cross-ploughings are made before sowing. To destroy the weeds that grow luxuriantly in summer crops, repeated hoeings are followed.

This operation is primarily necessary to conserve the soil moisture and check the cracking of the surface. It is done by a hand implement called '*Fass*.' The outlay in fassing the cotton or sugar cane nearly equals the expense of all the other tillage operations of the crop.

### Summer crops

Summer crops require numerous waterings. The amount of water run in the main canals is calculated to give 25 cu. m. per feddan per 24 hours for the area cultivated with summer crops exclusive of rice. The water duty allowed for rice is about 40 cu. m. per feddan per 24 hours. In the case of cotton, sugar cane, potatoes and other crops requiring judicious waterings, sowing is done on ridges. The ridges are prepared by the ordinary native plough with the addition of a triangular piece of wood between the sole and the beam. They are then made up by the '*Fass*.' The ridges also give more adequate seed beds and permit the protection of the seedlings against the cold northern winds, by making the holes for the seed on the opposite side.

The harvesting of crops is mainly done by hand labour. Cotton is picked by small boys or girls. It is then spread out on clean sackings, and the dead locks removed from it, before it is put into the bags and carried to the stores. Cereals are reaped with sickles. Thrashing is done with the '*Norag*.' The separation of the grain from the straw is done by throwing the mixture into the air with the aid of a wooden fork, '*Midrah*.' Threshing machines are used in the big estates. The seed is generally cleaned by a series of hard grain-cleaning utensils.

### Farm crops

#### (*a*) Cotton

Cotton is the backbone of Egypt's present wealth. Mohammed Ali, the founder of modern Egypt, took an interest in extending the cultivation of this plant, subsequent to the discovery by the French engineer, Jumel, of a cotton tree growing in a garden at Shubra (Cairo) belonging to Mohammed Bey el-Orfali, late governor of Kordofan and Dongola. At that time cotton was grown around the fields; and Jumel thought that the plant he came across would give a superior lint and would be a profitable article for export to Europe. Jumel, in partnership with a native merchant, multiplied a few seeds in a piece of land near the obelisk at Mataria in the vicinity of Cairo, because he could not come to an agreement with Mohammed Ali as to the remuneration he asked for. He obtained a crop of three bales which he shipped to Europe in 1820. These three bales of Maho, or Jumel, cotton formed the first consignment of Egyptian cotton exported. Encouraged by the reports received from the spinners on this consignment, Jumel again approached Mohammed Ali, who recompensed him and engaged him in his scheme to extend cotton-growing, out of which he made a monopoly. With the death of Mohammed Ali and his son, Ibrahim, the interest taken in cotton-growing waned. The Civil War of America (1861-1864), however, raised cotton prices enormously, and the fate of Egypt as a cotton-producing country consequently became established.

From the point of view of quantity, Egypt ranks as the sixth cotton-producing country, its produce being about 6% of the total world production. As regards staple, however, the position of Egypt is foremost, 40 to 50% of the total production of long staple cottons ($1\frac{1}{8}$ in. or longer) being obtained from Egypt. The maintenance of the high standard of Egyptian cotton has always been kept in view. All cotton seed used in sowing is carefully examined and cannot be sold except in officially sealed sacks. The improvement of the general stock of sowing seeds is attained by continually raising pure nuclei on state farms.

The unginned cotton is sold by the kantar, 1 kantar being equivalent to 315 Egyptian rotolis (lb.). This quantity is supposed to give 100 rotolis of lint (the standard equivalence of the kantar).

#### (*b*) Sugar cane

As an industrial plant, the sugar cane comes next to cotton. Its main cultivation is in the southern provinces of Upper Egypt, where it takes the importance that cotton obtains further north. This crop owes its extension to the Khedive Ismail Pasha, the grandfather of the present king, who grew it extensively on his private domains and erected several sugar factories. The cultivation of this crop was stimulated by the Cuban War. With the termination of this war, the area of the sugar crop had to be greatly reduced. The Société des Sucreries et de la Raffinerie d'Egypt, however, did much for the development of this cultivation. The company is at present the only buyer of sugar cane, with the exception of a small quantity which is sold for eating raw or for the local production of molasses, which find a great demand amongst the poor classes in the country.

#### (*c*) Onions

As a crop for export, the onion comes next to cotton. Egypt ranks third amongst onion-producing countries in the world. The Egyptian crop, however, ripens early and, therefore, obtains good prices in European and American markets in the beginning of the season.

#### (*d*) Cereals

Amongst cereals, maize is most widely grown, being the main material in the bread of the farmers. Millet generally replaces maize in Upper Egypt. Barley is grown for fodder, generally in areas which are too poor to yield a good crop of wheat. The Egyptian barley is not fit for malting, but the region of Mariut, near the Mediterranean Sea, grows barley which can be used for this purpose. In the north of the Delta and the low-lying district of Fayyum, rice is grown, generally for the purpose of reclaiming the land by the repeated application of water, which this crop can support and from which it benefits. The area of the rice crop is limited by the amount of summer water available every year.

#### (*e*) Berseem

The Egyptian clover, berseem, is widely grown to supply the main, or even the sole, fodder for the farm animals during about half the year. This most important crop gives four to five cuttings a year, each weighing 6 to 8 tons. Hay is generally prepared from the latter cuttings to serve as summer fodder. The crop is also grown as a catch crop before the cotton, and in this case only one or two cuttings are taken. Beans constitute the main dry fodder for cattle and are generally given with chopped wheat straw.

In addition to the crops already mentioned, others of minor importance are grown. Lentils, fenugreek and a green fodder called '*gilban*' (*Lathyrus sativus*) are crops grown in Upper Egypt. Earthnuts, lupins, sesame and henna (*Lawsonia inermis*) are crops grown in the sandy soils.

(*From the Bulletin, issued by The Egyptian Education Bureau, London.*)

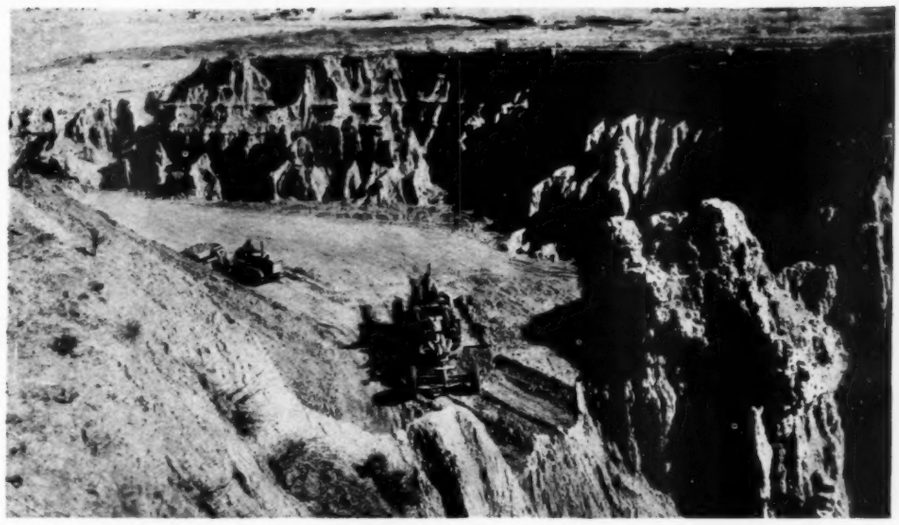
---

## Cyprus Offers Conservation Course

The Government of Cyprus has offered to provide a field training course in conservation and forestry methods, beginning this autumn, for young technicians from other countries of the Mediterranean region. The course will enable trainees to take part in and observe soil and water conserving operations on the island. Members of the Cyprus technical staff will be available for four months to help the visitors to become familiar with conservation problems and techniques of applying conservation measures.

# Dry Year for S. African Farms

*Interesting details of the agricultural position in the Union of South Africa during 1949 are contained in the Annual Report of the Department of Agriculture in South Africa published in the official journal, 'Farming in South Africa,' from which the following account has been extracted.*



**Heavy machinery in action in the Drakensberg conservation area**

AT the commencement of last season everyone was optimistic about the coming year, for early summer rains had then already fallen. Unfortunately, optimism soon had to make way for the realisation that the summer season was, and remained, a bad one. Once again farming industry found itself in the stranglehold of a severe drought—a drought which was not confined to certain parts of the country only, but which made itself felt from the wheat lands of Swellendam and Riversdale to the Limpopo. The only part which was at all normal was the Eastern Highveld of the Transvaal.

The proportions of the drought, the losses in products and in livestock and the misery and poverty which followed in its wake will occasion a severe setback to the agricultural industry. The fact that there were no less than 113 districts on the list of drought-stricken districts testifies to its widespread nature.

### Soil conservation

It cannot be sufficiently emphasised that soil conservation, i.e. farming methods adapted to nature, is the only lasting means of controlling droughts. We have violated and maltreated nature, and we can see for ourselves how our veld and the productivity of our soil decreases year by year causing the annual rainfall to be of less and less value. It is true that the soaking rains of yore have not fallen for several years, but, in spite of the enormous powers of recovery so characteristic a feature of this country, the older people amongst us will say that the veld does not recover as quickly as it did formerly. Its potentialities for growth and production have been damaged, and only the utmost care and the application of the most scientific methods of veld control can restore the veld our forefathers knew and secure it for posterity.

In the use of the machinery of the Soil Conservation Act and in the application of the principles of soil conservation lies our security. Fortunately, the whole country is becoming conscious of this, and an increasing number of soil conservation districts are being proclaimed in addition to the few hundred already established. The expectation is that the whole country will be covered by such districts within a measurable space of time.

The enthusiasm with which the proclamation of districts was heralded seems to be gradually making way for impatience that the rate at which the actual operations are proceeding cannot be speeded up. This impatience is understandable, but the Department of Agriculture is hampered by a shortage of staff, machinery, wire and labour.

The Department is doing its utmost to solve staff difficulties and to extend its personnel. The position is gradually improving, but there is a world-wide shortage of technicians. Technical staff cannot be obtained from overseas. The country has to depend mainly on young men from our own universities and colleges, which means that establishments can only be supplemented at the rate at which young men graduate from our institutions, which must at the same time supply technicians for industry, private farming and transport.

As far as machinery and the indispensable wire are concerned, the country is at present faced with a currency problem, which makes import control essential. For the time being, therefore, we shall have to make do with what we have.

These are hard facts, and they are mentioned in order that the soil conservation programme may be seen in the right perspective. They force one to realise that the work cannot be completed in a year or two. This is long-term work which will probably occupy at least two decades. Here we are not thinking of the filling up of dongas—these will have to be fenced off and left to nature—rather are we thinking of conservation farming, farm planning, proper crop-rotation systems and scientific veld control. With a little technical guidance and advice farmers can apply most of these principles without the use of heavy machinery.

### Mechanised farming

In the Union, as in many other agricultural countries, an urgent necessity still exists for increased food production, and, since we in the Union are faced with a limited agricultural potential it is the more necessary for our farming industry to develop to the highest level of efficiency.

During the war farmers were severely handicapped by the scarcity of farming machinery, at the very time when an increase in production was highly necessary. Although the position has since improved, there is still a scarcity of tractors, particularly the heavy types, tractor equipment and power-driven machinery, owing to the fact that old machinery has to be replaced and that farmers are compelled by the increasing labour difficulties to acquire power-driven machinery which necessitates fewer labour units.

Some 2,529 tractors were imported during 1946 and some 3,841 during 1947, while in 1948 the number had increased to 10,822. These figures, although they only refer to tractors, bear witness to the rapid mechanisation of the farming industry during the past few years.

### Fertiliser supplies

Supplies of fertiliser did not improve to an extent, allowing of free distribution through the trade, and consequently their control was retained during the past year. It was expected, however, that more fertiliser would be available after April 1949, and for this reason new data were obtained from fertiliser consumers to serve as a basis for allocations after April. Some 55,000 applications were received for a total amount of 620,000 tons of superphosphate, while only 380,000 tons of superphosphate were available for distribution as superphosphate and for the manufacture of fertiliser mixtures. Permits could therefore be issued for 300,000 tons of superphosphate and 130,000 tons of mixtures.

The reduced quantity of superphosphate available was caused by an unavoidable delay in the delivery of certain machinery parts for the new fertiliser factory. Prospects for this year are therefore considerably better.

Nitrogen supplies were sufficient only for the minimum requirements of all the industries, as reflected in their applications. Permits were issued for approximately 4,000 tons of nitrogen.

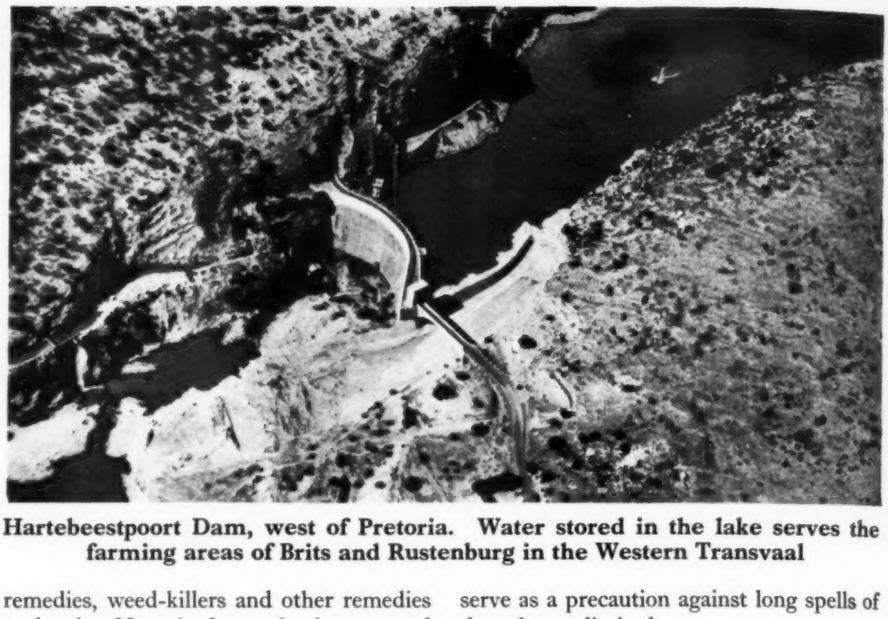
Supplies of potash (potassium chloride), in contrast to the insufficient amounts of superphosphate and nitrogen, were sufficient for the requirements of applicants, so that approximately 1,600 tons of unmixed potash could be allocated to consumers apart from the potash used in mixtures.

### Agricultural standardisation

When the S.A. Standards Council and its Bureau of Standards were established in 1945 it was decided to appoint a committee which would be responsible, through the Secretary for Agriculture, for all matters concerning standardisation and grading which involve the Department of Agriculture or the agricultural industry.

Specifications for fertilisers, stock feed, seed and stock remedies were drawn up under Act No. 36 of 1947 by the sub-committees concerned and were circulated for remarks by interested persons. The specifications were subsequently finalised by the committee and have already been announced by way of regulations.

The sub-committee charged with the framing of specifications for plant-disease remedies, weed-killers and other remedies under Act No. 36 of 1947 is also engaged on the final stages of its work.



**Hartebeestpoort Dam, west of Pretoria. Water stored in the lake serves the farming areas of Brits and Rustenburg in the Western Transvaal**

The Bureau also referred the following specifications to the Agricultural Standardisation Committee:

(1) Standard specifications for concrete fencing poles and stays, drawn up by the New Zealand Institute of Standards.

(2) Specifications for the normalisation of tractors, drawn up by the International Commission for Agricultural Engineering.

(3) Model regulations for farm-dairy buildings drawn up by S.A. Bureau of Standards.

(4) Specifications for poultry rations, drawn up by the S.A. Bureau of Standards.

The sub-committee attending to the framing of grades for lucerne hay submitted a recommendation to the committee for the drawing up of a colour chart, showing the various colours of lucerne hay, to be used for grading. The Bureau of Standards is co-operating in the investigation to find a reliable short method of determining the moisture content of lucerne hay and cereals.

### The fodder bank scheme

The committee appointed to investigate the desirability and practicability of the establishment of a fodder bank completed its report during February 1949 and submitted it to the Department.

In its approach to the matter the committee carefully considered all aspects of the problem and decided as follows:

(1) That protracted droughts resulting in severe stock losses occur mainly in the western half of the Union, in regions with an average annual rainfall of less than 15 in.

(2) That for many farms in these parts, and particularly in those with an average annual rainfall of 10 in. and less, the chances of producing fodder sufficient to serve as a precaution against long spells of drought are limited.

(3) That if sufficient grazing has to be maintained to provide for an abnormal long spell of drought the result in most cases would be such uneconomical use of the normal grazing as to constitute an unreasonable demand on most of the stock-farmers concerned.

(4) That the possibilities of trekking with stock (by road or rail) in times of severe drought are becoming so limited that farmers who do not themselves own farms in various parts of the country will have to arrange their farming systems in such a way that they can endure long droughts without trekking.

(5) That, in view of the fact that it is uneconomical on many farms in low-rainfall areas to produce sufficient fodder or reserve sufficient grazing to serve as a precaution against a long spell of drought, it is desirable for farmers on such farms (who cannot trek with their stock) to buy fodder produced elsewhere.

(6) That the storing of *bought* fodder supplies on individual farms in the low-rainfall areas is uneconomical and impracticable.

(7) That for this reason it is necessary to provide for a *fodder supply scheme*, under which the fodder requirements of stock-farmers in low-rainfall areas during crisis periods can be *collectively* purchased and stored for exclusive use during times of severe drought, and to the expenses of which the State will also have to contribute.

In the light of these considerations and conclusions the committee recommends that a drought insurance scheme for farmers, under which fodder can be bought and stored, be established under certain conditions.

[*Photos: State Inf. Office, Union of S. Africa.*

# Control of Citrus Pests in California

*Although production of citrus in the United States doubled in the ten years 1937-47 and is still increasing, Californian production did not alter greatly in that time, and there is no indication of a prospective increase in that State. Red Scale and citrus mites are the two worst pests, and the following account by F. M. READ, M.AGR.SC., Chief Inspector of Horticulture, Victoria, describes the control methods used in California, compared with those employed in Australia.*

PARTICULAR interest attaches to a comparison of red scale control measures in California and Victoria. Fumigation of citrus trees is the favoured method along the Murray Valley, spraying with oil being resorted to usually only when fumigation is unavailable. The reverse obtains in California, where only about 30,000 acres are fumigated, over 200,000 acres normally relying on oil sprays to control red scale.

There are several reasons for this preference for oil in California. Citrus mites, which are not controlled by red scale fumigation, are a major problem in California, sometimes being more important than red scale itself. Thus, on fumigated groves, spraying has still to be resorted to for mite control. Even where this additional spraying is not necessary the cost of fumigation is more than 50% greater than the cost of spraying.

It is generally feared in Victoria that continued oil spraying may have a depressing effect on the growth of the tree, and it is of interest to note that, despite the fact that the quality of spraying oils is controlled by regulation, in California, more than in any other part of the world, there is still the feeling that oil sprays may have been partly responsible for the slow decline in vigour of trees and may affect fruit quality. There does not seem to be, however, in California, any conclusive evidence that this is actually so, though at times some reduction in fruit quality has been recorded, and plant physiologists have pointed to a lower dry matter content in the leaves of oiled trees, as compared with those fumigated.

### Oil sprays

Californian regulations require spraying oils to disclose the degree of refinement by stating the percentage of unsulphonatable residue—that is, the paraffinic and naphthenic hydrocarbons which remain after deducting the aromatic or unsaturated hydrocarbons, which are sulphonatable and which are considered to be mainly responsible for tree injury. Oils used on citrus in California have over 90% and usually over 92% U.R.

Light to light-medium oils are used for citrus and the regulations limit the degree to which such grades may be produced by blending of different distillation fractions of oil. Sellers are required to state the percentage of the oil which distils under 636°F. and there is, in addition, a limit on the range of distillation. The ultimate aim is to use ' straight run ' oils distilling over a narrow range of temperature in preference to blends of heavy and light fractions.

There is no feeling of complacency about the oils in use in California, and greatest interest attaches to recent researches in New York state and Pennsylvania on the insecticidal and phytocidal properties of the actual hydrocarbons contained in the oils. It is not impossible that if oils containing only the most effective hydrocarbons were available, the spraying strength could be reduced to quarter of the the present level with a consequent reduction in the possibility of tree damage.

It may be that superior oils will cost significantly more than standard oils do now, but American opinion is that such increases would be justified, judging by results obtained from the preliminary experiments already conducted.

Oil sprays are used in California at a strength of $1\frac{2}{3}\%$ actual oil and the strength aimed at is that which is sufficient to kill the adult females. It has often been suggested that oil sprays should be applied when large numbers of scales are in the ' crawler ' stage, but entomologists at the Riverside Experiment Station pay no attention to ' crawlers,' holding that a spray sufficiently strong to kill the more resistant adult female is, in any case, necessary. The spray kills the female not by covering it but seeping underneath it.

### Growth regulators

Growth regulators added to the spray oil have been shown to reduce the tendency of trees to shed leaves and small fruits after being oil sprayed. A general recommendation has been made in California that six parts per million of 2-4-D may be added for this purpose. In addition, this practice has tended to increase fruit size and to reduce the amount of twig dieback. On lemons it has increased storage life by up to 50% by holding the buttons on the fruit for longer and thus reducing losses from Alternaria or ' black central rot ' which gains admission at the button scar.

The new insecticide, Parathion, has given promising results against red scale at a strength of $\frac{3}{4}$ lb. per 100 gal., but at present prices it is too dear for use. From the public health point of view, Parathion probably would be much safer on citrus, because of the time of its application, than on other fruits.

### Spray equipment

Most spraying is done by contract in California, and the standard equipment used consists of a portable spray truck with a tank of 400 imperial gal. from which three hand-directed hoses are operated. Two hose-men on the ground spray the sides of the trees on either side of the spray truck, while the third man occupying a tower, usually hydraulically elevated above the tank, sprays down on to the tops of both trees, using a specially modified walnut gun to produce a narrow and penetrating spray.

A pressure of 600 lb. can be maintained easily at the guns, but it is suspected that such high pressures frequently cause skin blemishes in the fruit and a pressure of 400 to 450 lb. is considered ample by careful operators. Thorough spraying is a feature of the work, 400 gal. being sufficient to cover adequately only about 16 large trees of a height of, say, 13 to 15 ft.

The contract team consists of five men: three hose-men already referred to, a driver for the spray truck and a driver for the refilling unit. This is another truck with a 400-gal. tank and a quick delivery

pump capable of transferring this gallonage in 1½ to 1¾ minutes. Such a team would, on the average, spray about 600 trees a day, the contract price being 9s. per 100 gal. applied, plus the cost of materials. The cost of the spray outfit would be about £4,500.

There does not seem to be much interest in the 'speed sprayer' and similar air-carrier equipment in California, or in the fixed spray type of equipment, though the latter is used to some extent on lemons. Aerial spraying is not advanced in the citrus groves of California as it is, for instance, in the apple-growing areas of Washington, but helicopters have been used to a limited extent. In one case, on lemons, 3 gal. per acre of a concentrated aerosol containing 2,400 parts per million of 2-4-D had been used to control fruit drop.

**This American sprayer uses a powerful motor and ten aircraft propellers to throw a stream of germ and insect killing liquids in a Californian orange grove**

## Fumigation

A strict comparison between fumigation of citrus for red scale in Victoria and fumigation in California cannot be made because while in Australia a fumigant, calcium cyanamide powder, is used, the Americans use almost exclusively liquid hydrogen cyanide vaporised by heat prior to blowing into the tent. They regard the calcium cyanamide as being inferior in its kill and more dangerous to the tree. Apparently the dangerous nature of the liquid in transit and storage is one of the main reasons why it is not used in Australia.

With hydrogen cyanide, California can safely fumigate from July to the end of February, equivalent in Victoria to January to the end of August. Daylight fumigation is not practised, except that, through the winter months, work may commence at 3 p.m. to 4 p.m. when the air is still.

The standard tent material was previously 7 to 8 oz. duck, but recently this has been scarce and most tents are now made of 250 drill, both materials having a tearing strength of 11 to 12 lb. Nylon tents are convenient to use, being one third the weight of duck and less than half the weight of drill, but the concentration of the fumigant drops slightly more rapidly under nylon than under the other materials. Actually, the nature of the material is not as important in determining the drop in concentration as are atmospheric conditions outside the tent. The cost of nylon is about double and there are relatively few in use. When new they have a tearing strength of 35 lb., but in twelve months this has fallen to 18 lb. The Dupont Co. has been interested in the manufacture of a better nylon for fumigation tents. More interest, however, is probably being evinced in another synthetic product, Koroseal, which it is considered would be extremely durable in use.

A little while ago there was considerable interest and research in America on gas-tight tents which would maintain a steady concentration of fumigant, but even under experimental conditions they have proved very dangerous and there is no interest whatever now in the use of such tents.

## Tent pullers

Practically all tents are now pulled over the trees and removed after fumigation by mechanical means. In fact, it is impossible to obtain labour to manipulate the tents by hand, because of the nature of the work. The tent pullers, overall, do not significantly reduce the cost of fumigation, but labour is offering for work in fumigation gangs where a tent puller is used. Where the machines can obtain a good long run on trees of moderate to large size and free of snags, they are probably a good deal cheaper than hand pulling, but on small trees and snaggy trees and broken runs, efficient hand pulling would probably be cheaper.

The applicator for hydrogen cyanide, which can be wheeled easily from tree to tree, consists of an accurate dosage regulator from which the liquid fumigant passes through a copper coil in a water bath heated by a steam coil, which itself is heated by a petrol burner. When vaporised, the fumigant is blown through a flexible hose under the tent. This method of application results in a rapid attainment of the maximum concentration within the tent and seems to be quite standard in California.

## Resistant scales

The presence of scales resistant to normal fumigation dosages is a frequent reason for using a combination of fumigation and spraying, the spraying following the fumigation at not more than a month nor less than ten days' interval. Apart from the problem of resistant scales, spraying tends to be more effective against the outer scales on the periphery of the tree, while fumigation tends to be more effective against scales towards the centre of the tree.

Where a grower suspects that he has a build-up of resistant scales on his grove, he may submit a sample to the entomologists at Riverside Station, who have developed a special test chamber in which the scales from the grove in question are fumigated under the same conditions as a control line of scales continually bred for this purpose in the insectory. The concentration of fumigant in the test chamber is not kept constant, but matches the curve of concentration experienced under a field tent.

Resistance to fumigation in scales is a genetic factor. There are apparently two races of scales in California sharply

distinguished by their susceptibility to cyanide. Each of these two races has been bred through 12 generations at Riverside and subjected throughout to fumigation tests. It has been found that they have not varied in their response to fumigation over this time. That is to say, scales do not acquire, as a result of fumigation experience, a greater resistance to subsequent fumigation. Their resistance, or otherwise, depends on inherited characters.

### Biological control

The Division of Biological Control at Riverside aims at controlling citrus insect pests by the use of parasites. Already the yellow and black scales appear to be under biological control and the work on red scale and mealy bug is promising. There are, in California, some groves on which red scale does not build up, even though no spraying or fumigation has been practised for, in some cases, 7 to 8 years and, in a few cases, even for 12 to 15 years. An intensive study of such groves is yielding results of the greatest interest.

The main predators on red scale appear to be ladybirds and the Golden Chalcid (*Aphytis chrysomphali*). Ladybirds attack adult scales, while the Golden Chalcid attacks only young scales. A combination may, therefore, be desirable, but there are groves on which red scale seems to be naturally controlled where the Golden Chalcid is the only predator to be found, and it is considered to be the most promising of all the scale parasites.

Californian entomologists believe the Golden Chalcid to be world-wide in its distribution and to occur wherever red scale is found. They think this insect has been under-estimated because it does not lay its eggs in the scale body, but instead the eggs are laid under the scale covering, the young chalcid feeding on the scale through a specially developed tube. Thus, in some groves where the Golden Chalcid occurs freely, there has been found a high mortality among the scales, but no direct evidence that this was associated with the Golden Chalcid.

The limitation in chalcid control is considered to be due to the fact that natural variations in the numbers of chalcids and scales throughout the year are out of phase, *i.e.* when scales are decreasing chalcids would still be increasing if sufficient scales were present to support their greater numbers. It is necessary, therefore, in the insectory to do one of two things; either breed scales to be liberated as a source of feed at certain times in the grove, or to breed Chalcids in the insectory for liberation in the field at appropriate times. Over half a million Chalcids per day can be produced in the Riverside insectories for liberation, and though the work is only in the experimental stage, it is being prosecuted now with considerable and increasing vigour. In addition to the broad study of host parasite relationship, the entomologists are looking for strains of parasites which are particularly efficient.

It cannot be stated yet that biological control of red scale is practicable, nor that it will ever be practicable under all growing conditions, but Victorian citrus growers will watch with the greatest interest this work by a group of entomologists who believe that spraying and fumigation may actually be the *cause* of red scale by affecting in the long run the population of natural controlling parasites more than they control red scale itself.

(*Journal of the Dept. of Agriculture*, Victoria, Australia.)

## *U.S. Aid for British Farming*

Modern American developments in various fields of agriculture, ranging from soil fertility to farm management, will be available in the United Kingdom through five Marshall Plan projects announced by the Economic Co-operation Administration Mission to the United Kingdom.

Under ECA's Technical Assistance Programme four British specialists will make studies in the United States in their respective fields and one American specialist will make a survey in Great Britain.

The five projects provide for:

(1) Recommendations for possible improvements in British farm management based on a two-month study in the United Kingdom by Dr. Sherman E. Johnson, Assistant Chief of the U.S. Department of Agriculture's Bureau of Agricultural Economics. He is studying labour efficiency on British farms, the effect of farm building layout and design on output per man, planning of the day's work and the relation of farm-cropping programmes to labour productivity.

(2) A three-month study of U.S. planning of farm buildings by Dr. David Souter, Advisory Officer on farm buildings of the North of Scotland College of Agriculture.

(3) A two-month study of U.S. grassland improvement techniques by Dr. William Davies, Director of the Grassland Research Station for Britain.

(4) A four-month poultry husbandry study by Miss Jean Wallace, poultry instructress at the West of Scotland Agricultural College.

(5) A two-month study of U.S. dairy farming practices by Mr. Roger Turner, agricultural economist at the West of Scotland Agricultural College.

In requesting the projects the British Government said that increased agricultural productivity requires first-hand knowledge by British experts of new techniques developed in the United States during the war and post-war years.

## *News from France*

### Grain and grass

It was pointed out in this journal last month that the use of hybrid maize is becoming more and more widespread and a report from France indicates that maize hybrids are to be used for increasing the domestic production of that crop.

Despite the fact that France's maize needs are about 12 million quintals a year and production in a good year amounts to only 5 million quintals, maize production has dropped considerably over the past few years, to be stabilised at about 300,000 hectares. This is due to competition from foreign maize, which is much cheaper. However, for 1952 the Monnet Plan envisages a production of 7,200,000 quintals over an area of 370,000 hectares, to be achieved by modernisation, increased output and extending zones of culture. Experiments with maize hybrids have been undertaken to determine the varieties suitable and experience has shown that they are clearly superior to ordinary maize for their solidity, endurance and the relatively small grain which makes sowing more economical (15 to 20 kg. per hectare instead of 30 to 35). Ears are also greater (18 to 22 instead of 12 to 16) and output is higher, while their regularity will enable the harvest to be mechanised, thus economising in labour and lowering cost price. American hybrids will be used for a start.

### Grassland improvement

International experts met last month in Paris to study methods of improving grassland in Europe. Experiments on the subject have been numerous over the past few years and the meeting was designed to enable the experts' ideas and results of experiments to be diffused so as to draw from them the best possible techniques. Following the conference two visits were made in Normandy and the north-east of France to enable delegates to evaluate typical results by French producers and technicians.

**Typical Myall scrub and saltbush country between Port Augusta and Hesso, South Australia**

# The Saltbushes of S. Australia

**R. W. JESSUP, M.Sc.**

*Soil Conservation Officer, Department of Agriculture for South Australia*

*Saltbushes can be extremely helpful in conserving the soil, particularly in areas of sparse vegetation and dry climate. The more common species found in South Australia are described in the following article.*

NEXT to the bluebushes, saltbushes are the most important and widespread plants growing in the semi-arid and arid pastoral country of South Australia. They belong to the genus *Atriplex* and are closely related botanically to the bluebushes and bindyis. Twenty-two different saltbushes are found in South Australia and their usefulness in conserving the soil is potentially very great.

As a group they are characterised botanically by having inconspicuous flowers and, unlike most flowering plants, the male and female reproductive organs are not found together on the same flower, although male and female flowers may be found on the same bush. Pollen from the male flowers is blown by the wind to the female flowers.

## Bladder saltbush

### *(Atriplex vesicaria)*

The most important of the perennial saltbushes is the bladder saltbush, which grows to a height of 1 to 2 ft., has an average life of 12 years and is palatable to grazing animals. It is a shallow-rooting shrub, most of the roots being within a few inches of the soil surface and on rare occasions only are any to be found deeper than 1 ft. After rains special short-lived feeding roots are produced that enable the plant to absorb moisture more rapidly. These roots die when the soil dries out.

The silvery-grey colour of the leaves is due to the presence of a surface cover of hairs. At night in the pastoral country air temperature drops rapidly and the air may become nearly saturated with water vapour. When this happens bladder saltbush can absorb moisture into its leaves through these surface hairs. During the day the hairs lose their moisture and collapse to form a felt-like protective cover over the leaf surface. This helps to prevent loss of moisture from the leaf tissues. In contrast to this, most other plants have a waterproof cover over their leaves to prevent excess loss of moisture, and this prevents them from absorbing any moisture from the air. The ability of saltbush to absorb moisture into its leaves is one of the reasons why it is able to grow in very low rainfall country.

Bladder saltbush is a prolific seeder, so that no difficulty is experienced in gathering sufficient seed for the reseeding of small areas of country. As it requires cool temperatures for germination, good establishment seldom follows summer rains. Not much large-scale reseeding has been done, but results show that best results are obtained by seeding during the winter. Indications are, however, that it is useless to broadcast the seed on bare country without first furrowing it, preferably across the direction of the prevailing wind. Germination has been quite satisfactory without special mechanical covering of the seed. In experiments on reseeding carried out in the north-east of South Australia a sufficiently dense germination was obtained by broadcasting a 4-gal. tin of seed over a length of $\frac{3}{4}$ mile of furrow.

## Strains

Bladder saltbush is not a uniform species, four different strains being known. Under natural conditions each strain has its own soil preferences. Strain 1 is found on soils containing large amounts of lime at shallow depth. It is an erect, woody bush, and bladders are commonly absent from the fruiting body. Sometimes only very small bladders may be developed. This strain is the one which grows on the open saltbush plains of the north-eastern pastoral country. It is also to be found in the north-west in association with myall, mulga and bluebush on soils with lime at shallow depth.

Strain 2 grows on heavy soils (those with clay or clay-loam at or very near the surface). It is a robust, rounded bush with

very large bladders on the fruiting bodies and is the principal plant on the clay soils of the tableland country of the southern portion of the north-west of the State.

Strain 3 is an erect woody shrub with very well-developed bladders on the fruiting structures. It is associated with sandy soils and is widespread on the sandy soils of the north-west pastoral country which carry mulga.

Strain 4 is the largest of all varieties. It has an erect woody growth habit and the fruiting structures are generally without bladders. Its soil requirements are not fully understood, but it is obvious that this strain should be used when attempts are being made to reseed hill slopes with shallow soil among rock outcrops.

As a result of these natural soil preferences of the four strains of bladder saltbush, it is reasonable to assume that most success is likely to result from reseeding if the strain used is that which would have occupied the country under natural conditions. For example, seed from plants growing on clay soils of watercourses should not be used for the reseeding of higher country away from the watercourses, where the soil is invariably lighter textured and contains much lime. Strain 2 can be expected to give good results if used for reseeding heavy soils such as are found on the plains of the northern marginal lands.

### Mallee or Bitter saltbush

### *(Atriplex stipitata)*

This perennial saltbush resembles bladder saltbush in general appearance, but can be distinguished from it by its bitter taste. It has grey-coloured leaves which are somewhat narrower than those of bladder saltbush. In addition to being less drought-resistant, it is shorter lived than the bladder saltbush, the average life of the species being about eight years.

As the common name implies, mallee saltbush is widespread throughout the mallee country, particularly on stony mallee soils. Unfortunately, however, it is of no value, being unpalatable to stock on account of its bitter taste.

### Old Man saltbush

### *(Atriplex nummularia)*

Old man saltbush is the largest-growing species of any of the saltbushes and reaches a height of about 10 ft. The leaves are bluish-grey, roughly pear-shaped and over an inch across.

It is a prolific seeder and the main seed crop is produced in the autumn. It is fairly palatable to stock and will grow on a wide variety of soils from sands to clays. It is of rare natural occurrence in South Australia, but is commonly used as a hedge plant, for which it is well suited. Its tolerance to salt makes it a valuable species as a hedge plant on saline soils. Under natural conditions it shows preference for alkaline soils of moderate to heavy texture, such as are found along the flats adjacent to the River Murray.

### Flat-topped saltbush

### *(Atriplex halimoides)*

This is probably an annual species, although it may be a short-lived perennial with leaves much the same shape and colour as those of bladder saltbush. It may be distinguished from the latter by its smaller growth, as it rarely exceeds 6 to 9 in. in height, and by the fact that it is not a woody shrub. Further, the fruiting bodies are flat topped, while those of bladder saltbush are spherical.

Being practically unpalatable, it is of little value as a stock feed. Heavy-textured soils (clay loams and clays) suit it best and it is most common in South Australia on the clay soils of the tableland country of the north-west.

A high density of flat-topped saltbush usually indicates overgrazing of the pasture. When the valuable bladder saltbush is destroyed by overgrazing its place is often taken by flat-topped saltbush, which is a more prolific seeder and much less palatable to stock.

### Pop saltbush

### *(Atriplex spongiosa)*

This is a well-known annual species which is similar to flat-topped saltbush in appearance. It differs, however, in that the seed is enclosed in a lemon-shaped spongy covering about $\frac{1}{4}$ in. in diameter.

It is a prolific seeder which is rarely grazed by stock and grows on a wide variety of soils from sands to clays.

### Berry or Creeping saltbush

### *(Atriplex semibaccata)*

As the common name implies, this perennial species usually grows flat on the ground or may reach a height of about 6 in. The leaves are greenish above, grey below, up to 1 in. long and roughly oblong in shape. The seed is enclosed in two diamond - shaped, red - coloured, fleshy structures up to $\frac{3}{16}$ in. across.

This is a palatable species which seeds prolifically, especially in the autumn. However, it is of rare occurrence in the pastoral country, but is common in mallee areas.

### Slender-fruited saltbush

### *(Atriplex leptocarpa)*

Slender-fruited saltbush is similar in general appearance to berry saltbush, but the plants frequently have a more erect growth. The leaves may be distinguished from those of berry saltbush by being scaly-white on both faces. The fruiting body is herbaceous and is cylindrical in shape, $\frac{1}{4}$ in. long and $\frac{1}{16}$ in. in diameter. Seed is produced in abundance at any time of the year and germinates freely.

Slender-fruited saltbush is a very palatable species which does not occur naturally in north-western South Australia, but is common in the north-eastern pastoral country.

### Silver or Buck saltbush

### *(Atriplex rhagodioides)*

This is a spreading, twiggy, more or less rounded bush which grows to a height of about 3 ft. The leaves are silvery-grey in colour, ovate in shape and about 1 in. in length.

It is unpalatable to stock, but is included here because it is the dominant plant on the clay soils of the widespread tableland country of the far north-west of the State around Oodnadatta.

From the *Journal of Agriculture of S. Australia*, 1949, LIII (4).

[*Photo: Australian News and Inf. Bureau.*

---

## *African Land Utilisation*

The Inter-African Information Bureau on the Conservation and Utilisation of the Soil—one of the bureaux and permanent scientific committees which Belgium, France, Portugal, the Union of South Africa and the U.K. have established in accordance with the policy of technical co-operation in Africa south of the Sahara—has been set up in Paris.

The Bureau gives practical effect to the wish of these countries to see the best use made of the land resources of Africa and to promote the economic and social development of the indigenous population.

The Inter-African Soils Bureau (B.I.S.) will facilitate contact and establish permanent liaison between regional African committees on soil conservation, the Inter-African Pedological Service and all experts and national and international bodies concerned with these problems.

The seat of the Bureau is at the Museum National d'Histoire Naturelle, 47 Rue Cuvier, Paris.

# Mounted Implements on the Farm

*Mounted implements on the farm was the subject of an article in our issue for May 1950, in which one of the several existing forms of power lift linkage for tractors — the Ferguson system — was described.*

*Here we give an account of an alternative system developed by the Ford Company in connection with their Fordson Major tractor.*

**The Fordson hydraulic system in action. The right-hand furrow-side lifting rod is being adjusted for length in the fixed position**

THE Fordson system of linkage has been specifically designed to satisfy the demand for what is now known as the Mounted Implement.

The linkage enables implements to be attached to the tractor with ease. Both the tractor and implement form a compact and mobile unit, the implement being easily raised on the linkage for transport. The linkage provides pitch and levelling adjustments for all mounted implements, but in no way impairs the use of the tractors' drawbar for use with trailing implements. Provision has been retained in the drawbar for horizontal and lateral adjustments.

### Construction and operation

When considering the construction and operation of this linkage, it should be borne in mind that although it may appear intricate the adjustments normally incorporated in an implement are now designed into the linkage. Furthermore, it copes with all forms of orthodox tillage implements and it is sufficiently flexible to permit easy and fine adjustments.

The Fordson Major tractor and implement linkage consists of three main links, an upper link and two lower links, and two auxiliary lifting links on lifting rods. These are used to move the main linkage in the vertical plane through the auxiliary lifting links which are attached directly between the lower links and the lifting arms of the hydraulic power lift. The total arc of travel of the lifting arms is 78°, *i.e.*, 39° above and below the horizontal with the lifting arms fitted in the correct position. This arc of travel ensures ample clearance for transport and with an implement in the working position adequate depth range.

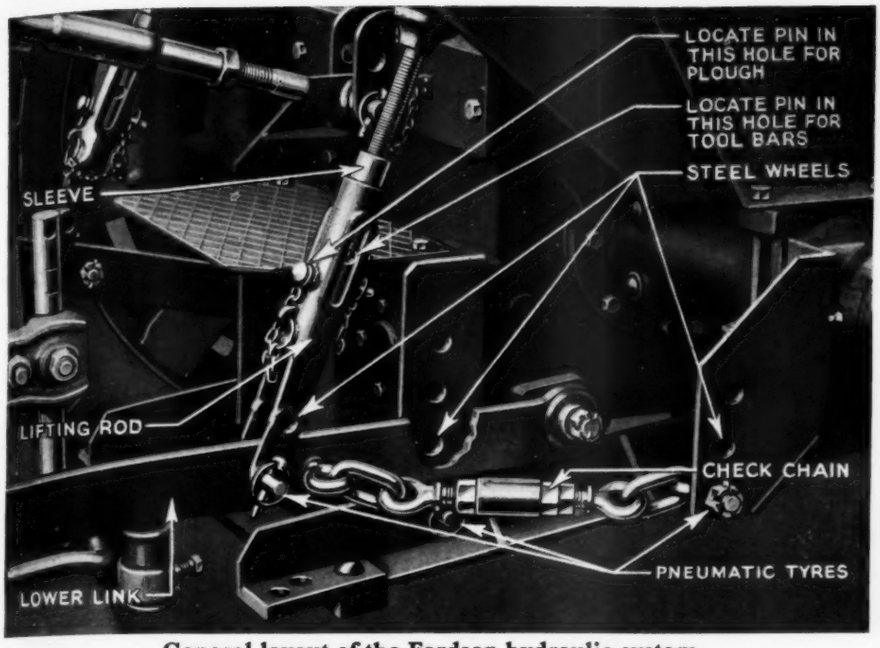
Two check chains are also fitted, one either side of the tractor between each lower lifting link, and a bracket rigidly attached to each half-axle housing. The check chains limit the lateral movement of the implement thus preventing the lower lifting links fouling the tractor's rear tyres. They are adjustable by means of a left and right hand screw thread and turn-buckle. In the transport position they are adjusted so that the lower links do not foul the rear wheels, but they should not be adjusted so tightly that when in work the plough is prevented from assuming its correct line of draught. When transporting an implement over rough ground for considerable distances, the check chains should be tensioned by hand so that the minimum lateral movement is possible. This reduces side sway of the implement and obviates the shock loading resulting from sudden arresting of the swaying implement by the check chains.

There are three points to which the linkage is attached to the tractor, and three points to which the implement is attached to the linkage and, for this reason, the system has become known as the three-point linkage. All attachments are ball jointed and there is sufficient movement to permit full implement adjustment in all directions.

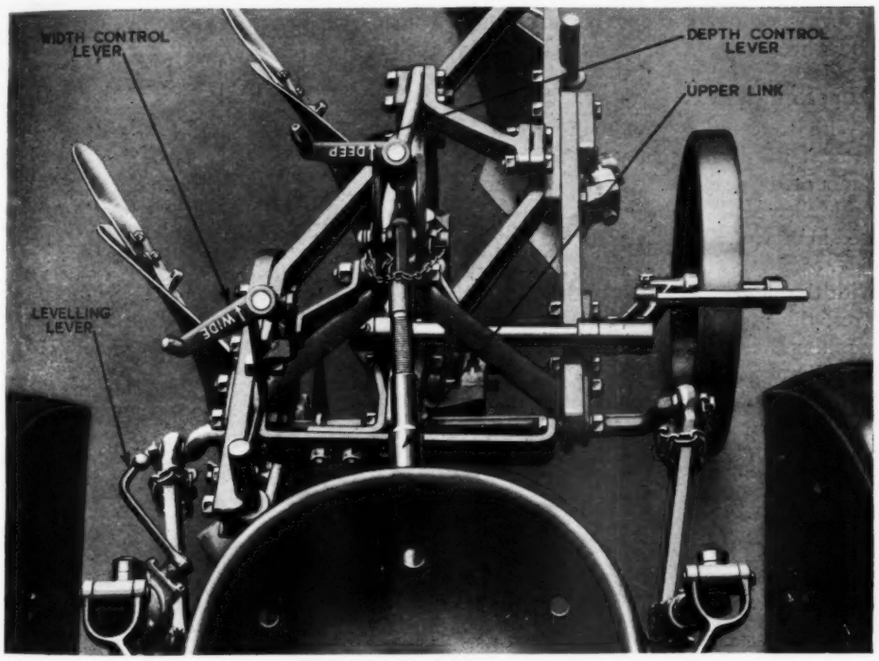
The main linkage consists of one upper and two lower links; the latter are not adjustable for length but are adjustable for height relative to the tractor by virtue of their forward mounting on the drawbar frame. There are four positions for the drawbar through which the pull through the lower links is conveyed to the implement. Two of these positions are required to suit both steel-wheeled and pneumatic-tyred tractors and permit the lower links to be positioned to give the best results for the particular implement in use, *i.e.*, when ploughing depth is near maximum the links should be in the lowest position.

The top link is adjustable for length and by varying its length the pitch of the implement is altered relative to the tractor. If a diagram is drawn of the linkage we should have two horizontal lines representing the top and bottom links and two vertical lines representing the tractor and implement frames. Such a diagram would produce an irregular four-sided figure having three non-adjustable sides and it would be seen that by varying the length of the top horizontal member (*i.e.* the top link) the implement will tilt or vary in pitch relative to the tractor.

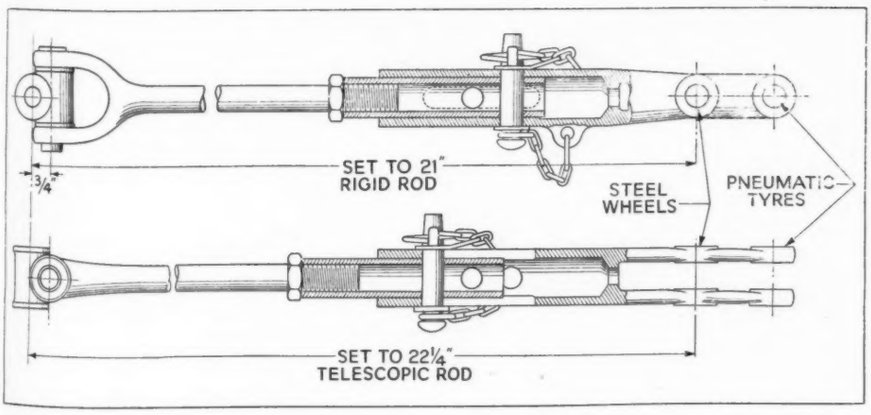
On all orthodox farming operations when the implement is in work and the tractor is moving forward, the lower links are in




**General layout of the Fordson hydraulic system**




**Plan view of the system**




**Plan view of the lifting rod set in the fixed and telescopic position**

tension and the upper link in compression. A reversal of these forces takes place when the implement is lifted clear of the ground and is carried in the transport position.

We will now consider the linkage as it would be seen in a plan view. The top link is on the centre line of the tractor and is carried near the top of the transmission housing. Here again there is a choice of attachment holes, the upper hole for use with steel wheels, the lower for use with pneumatic-tyred tractors.

The lower links, when attached to a mounted implement, converge towards the centre of the tractor and if lines were drawn through these links they would intersect at a point at or near the front axle and on the centre line of the tractor. Forces in this plane are all resolved at the centre line of the tractor. Therefore, there is no tendency for the link forces to cause tractor instability.

The two auxiliary or lifting rods are attached approximately halfway along the lower links at one end, and to the arms of the hydraulic power lift at the other. These two rods are not identical and are therefore not interchangeable. The right hand or furrow side rod incorporates a means whereby it is adjusted for length in the fixed position and is used when the implement has only one wheel to control the depth of work (i.e. mounted ploughs). These rods can either be set in the fixed or telescopic position, the telescopic position being used when the implement has two or more wheels controlling the depth of work. In the telescopic position such implements as toolbars have free vertical float over their whole length. As mentioned above, the rods will be set in the fixed position for implements having only one depth wheel and the implement can then be levelled in work by means of the adjustment provided in the furrow side lifting rod.

The yokes at the lower end of the lifting rods are provided with two holes, the upper for use with steel wheels and the lower for use with pneumatic tyres.

For work between row crops very little or no lateral float is required or desirable (except with steerage hoes).

For ploughing or other such implements, where the alignment of the implement is controlled on or at the implement, the chains should be slackened to permit the full lateral movement without fouling.

A safety chain is attached to both lower links near the implement ends so that when the tractor is being used without an implement the chains are joined together thus preventing the lower links fouling the tractor wheels.

**A Fordson Major tractor powering a high-pressure spraying machine for controlling scale disease on coconut trees in Trinidad. A tank load of 400 gal. can spray 150 trees in half an hour. The spray can reach a height of 50 to 60 ft.**

## N.Z. Tractor Market

New Zealand offers a good and developing market for tractors for agricultural and other uses, and the expansion of British tractor sales in the last three years has been almost spectacular.

The chief current demand for British tractors is for medium weight wheeled tractors. There is also a limited demand for crawler types previously supplied almost exclusively from the U.S. Several British manufacturers are now supplying light and medium crawler models to New Zealand, and increased shipments in this category are hoped for this year. It is, however, in the heavy crawler range that many farmers claim that the U.K. is still unable to supply a tractor as serviceable or as economical to run as American makes. Such tractors are used largely on the South Island wheatfields, on hilly country, and for all-purpose agricultural contracting.

## Rubber Tyres on Ploughs Save Tractor Fuel

EXPERIMENTS on the use of rubber tyres for stump-jump disc ploughs have been carried out by the School of Agriculture, University of Melbourne,* and results show that pneumatic rubber tyres can save between 15 and 34 gal. of fuel per 100 acres, depending on the type of soil.

The experiments were designed to embrace as wide a range and as many combinations as possible of soil types, steel and rubber wheels, depth of ploughing and speed of work. Four different arrangements of wheel equipment were used: All four steel wheels; rubber on furrow wheel only; rubber on furrow and land wheels; and all rubber tyred wheels.

### Wheel equipment

With the aid of a hydraulic dynamometer it was found that when the plough is mounted on steel wheels and worked on the Mallee sand, about 60% of the pull is used in moving the wheels and the remaining 40% doing the work of ploughing. With the plough mounted on four rubber tyres, the proportion is about 25% used in rolling the wheels and 75% in ploughing the soil.

Roughly half the saving is due to the use of a pneumatic tyre on the furrow wheel, which travels through the loose soil and is most likely to dig in. The land-wheel tyre is responsible for another 25% of the saving and the rear wheels for the remainder. It appears, however, that the plough is more easily controlled with steel rear wheels than with rubber-tyred ones.

### Speed

There is no significant difference in the drawbar pull required to work the plough when the tractor is in high or medium gear because, although higher speeds require more horse-power and greater fuel per unit of time, they reduce the time required to plough a given area. However, the liability of soil to drift is increased through excessive pulverisation of the soil due to high speeds.

### Drawbar height

The drawbar height has a significant effect on the force required to tow the plough on light soil, thus confirming the favoured practice of raising the drawbar height in light land. The high drawbar transfers some of the load from the plough wheels to the rear wheels of the tractor, thus increasing their rolling resistance; the total tractive effort remains practically unchanged.

* *Journal of the Department of Agriculture, Victoria.* 1950, **48** (2), pp. 73-76.

## U.S. Farm Machinery Exports

Although the European Recovery Programme countries took nearly $5,000,000 less United States farm machinery in 1949 than in 1948, ERP overseas territories took over $12,000,000 more, so that all the ERP areas were shipped over $7,500,000 or 8% more equipment than the year before. Non-ERP areas were shipped about $35,000,000 more farm machinery in 1949 compared with 1948, an increase of 12%. As a result, United States farm machinery exports (including all tractors) to all countries totalled $418,301,000 in 1949, over $42,500,000 or 11.3% higher than in 1948. As prices were only slightly higher in 1949, this figure represents an actual increase in volume.

**A Robust Universal cutter and chopper at work near Nairobi. Maize stalks are being fed into the machine**

ERP areas took only 16,804 wheel tractors in 1949 compared with 28,816 in 1948 as the supply of wheel types was more adequate in Europe than a year earlier. However, a total of 5,550 crawler tractors were shipped to ERP areas compared with 3,163 in 1948. Large-size crawlers still are not produced in sufficient types and quantities in Europe to meet the demand.

The value of exports of spare parts (repair parts) to ERP areas was higher in 1949 by 33%, and implements and equipment higher by nearly 20% than in 1948. Exports of power sprayers and dusters, tractor ploughs, drills and seeders, combines and pick-up balers to ERP areas were greater in 1949; exports of incubators and brooders, large hand sprayers and dusters, mowers, harvesters and binders, and threshers were less.

## Spray Manufacturers Combine

We understand that the syringe and hose fitting business of G. and W. Purser Ltd., Bromsgrove, has been transferred to W. T. French Ltd., of Birmingham, makers of *Mysto* horticultural sprayers and limewashers. For next season a new catalogue illustrating a comprehensive range of syringes, sprayers and pneumatic sprayers combining the essential points of both manufacturers will be issued.

It is hoped to give the trade a more effective service by combining the sales force of both companies and by rationalisation of products to make the companies more effective in home and export markets.

## Implement Range

Last month an article on the three-point linkage system was published in WORLD CROPS and the accompanying photographs show four of the Ferguson hydraulically controlled implements at work in the field.

The top picture shows a four-row steerage-hoe in action; the second operator can control lateral movement to the extent of 5 in. either side. Below that is a subsoiler, operated from the tractor seat and capable of penetration to a depth of 22 in. in dry soil. The third picture shows the Ferguson weeder which, besides being suitable for arable crops, has been found to be an effective substitute for the chain harrow on grassland. There are 71 delicately sprung tines which flick seedling roots clear of the soil without harming the crop. A 16 in. digger plough is shown in the bottom picture, turning over and burying rough, bracken-covered land. The tractor shown here has steel wheels in contrast to the more familiar pneumatic type.

## Survey of Middle East Markets

Mr. J. A. Hobbs, Manager of the Agricultural Machinery Division of the British Overseas Engineering and Construction Corporation, is making a survey of markets in the Middle East for British agricultural machinery, including products made by some of the members of the British Agricultural Machinery Manufacturers Export Association (BAMMEX). He is visiting Jordania, Lebanon, Syria, Israel, Turkey, Greece and possibly Iraq—in that order—and will probably be returning to London about the beginning of July.

## Small Grass Drier

The Tempiewood Mark I grass drier is a drier suitable for the farmer's own use, requiring the minimum amount of labour and capable of making a high quality and economical product from grass grown on the farm. The drier is a low-temperature, two-stage conveyor type, having a continuous output of 2¼ cwt. of grass with a final moisture content of 10% from 80% wet material. A seasonal output of 150 tons, when worked for ten hours a day by one man is quite normal.

### Drying process

The drying process is straightforward, fresh grass being hand-loaded into a feed conveyor and levelled off to a depth of about 2 ft. 6 in. This conveyor moves slowly forward, feeding the grass to a revolving teaser which transfers it to the drying conveyor in an even bed of minimum density. The drying conveyor, which is fitted with tines, carries the grass forward over a heated air stream until it reaches the end where it falls over and is drawn back over a perforated floor to the discharge point.

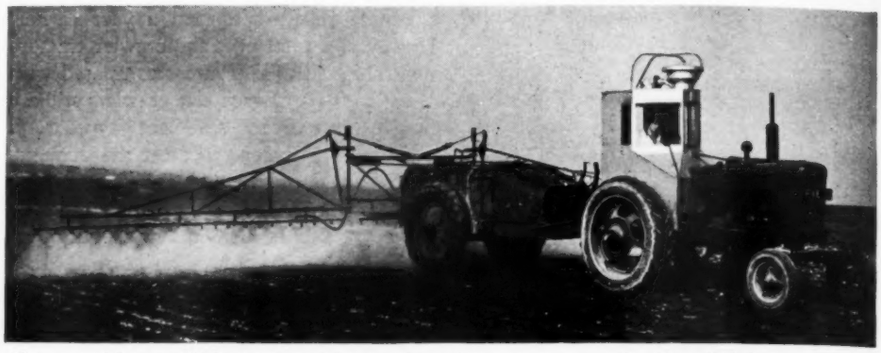
### Fuel and power

Heat is supplied by an oil-fired cylindrical steel shell furnace, heated air being circulated by a centrifugal fan. Recirculation of part of the exhaust gases is also incorporated. Any of the commonly used grades of fuel oil are suitable for burning as fuel for the drier.

Two three-phase electric motors of 2 h.p. and 7½ h.p. respectively, are the most suitable. One drives the feeder and the conveyors, the latter via an infinitely variable ratchet-type drive, giving control of drying time and output. The second motor drives the fan, blower and oil pump.

The whole plant covers a floor area of approximately 45 ft. long and 7ft. wide.

# Safety Precautions in using DNOC and Parathion



*Above :* **Air-conditioned spray-proof cab on a 511-gal. Cambridge sprayer.**
*Left :* **Filling spraying machine with chemicals ; note the protective clothing and rubber gloves**

A RECENT letter to WORLD CROPS called attention to the dangers inherent in the use of the highly-toxic substances parathion and DNOC in crop protection. An interesting sequel to this was a recent demonstration given by Pest Control Ltd. of safety precautions that should be adopted in handling these chemicals, at Bourn, Cambridgeshire.

In an introductory speech Dr. W. E. Ripper stressed these dangers and pointed out that they had resulted in a number of casualties and a few fatalities both in America and this country. He indicated that the points which required attention were as follows:

(1) Provision of gas-proof, air-conditioned cabs on the tractors to protect operatives against skin contact with spray drift and inhalation of toxic fumes.

(2) Bulk handling of the concentrated chemicals, thus avoiding the opening of numerous tins which is liable to result in the splashing of the operatives.

(3) Use of protective clothing.

(4) Issue of prophylactic medicine and a special supplementary diet which increases resistance.

(5) Regular medical examination of all workmen to ensure that dangerous quantities of toxic substances do not accumulate in their bodies.

(6) Provision of first-aid kits which contain antidotes for use in emergencies, also instructions for treatment of casualties to be handed to a doctor.

(7) Training the operatives to be ' safety conscious.'

(8) Scientific supervision of all spray operations.

In addition he pointed out that both DNOC and parathion showed cumulative effects in the body which might not be noticed until a certain stage is reached when sudden poisoning might occur. Large quantities of dinitro ortho cresol could be taken up by healthy individuals and become blocked in the blood albumen, but were capable of being released by certain stimuli, one of which is heat and another alcohol. The result might be fatal unless immediate treatment was given. In the case of parathion and similar organic phosphorous compounds, small quantities did not cause visible toxic symptoms but it caused the inactivation of one of the body enzymes estorase and further absorption might lead to poisoning or possibly death.

Dr. Donald Hunter subsequently emphasised that safety precautions were essential and unless these were observed death would certainly continue to occur.

A demonstration was then given of the equipment used in safety precautions; the value of clean white protective clothing which showed yellow stains if the operator was contaminated was explained and the specially protected tractor cab was demonstrated and its working explained. First-aid kit boxes which included detailed treatment instructions which can be handed to any doctor were also exhibited.

## Advantages of Hybrid Maize

Progressive farmers throughout the sub-tropical world are giving increasing attention to hybrid maize, with its economic advantages. In Southern Rhodesia, the results of the use of hybrid maize seed have been uniformly good and the demand has grown considerably. Last year 3,000 bags were produced, enough for planting 50,000 to 60,000 acres. Hybrid seed is smaller than ordinary seed and a bag of hybrid maize will plant 18 acres. The larger acreage means that even with the charge for the seed, hybrid maize costs only threepence an acre more to plant, while the increased yield of more than two bags an acre represents an additional return of £3 12s. for the same cost of plantings and cultivating. There must, however, be an additional cost of reaping and bagging, a cost to which the fortunate farmer is not likely to object. For this season it is calculated that there will be 14,000 bags for sale, enough to plant 250,000 acres. If this full quantity is put into the ground it will mean an extra yield of half a million bags.

## Royal Show for Southern Rhodesia

The constitution and rules of the new Royal Agricultural Society of Southern Rhodesia were adopted at a special general meeting of members of the Rhodesia Agricultural and Horticultural Society in Salisbury and the Royal Agricultural Society formally came into being, thus superseding, in effect, the Rhodesia Agricultural and Horticultural Society. The permanent offices of the Royal Society will be in Salisbury. The first Royal Agricultural show will be held from August 30 to September 2 at Salisbury and is expected to break all records for Southern Rhodesia. The secretary has been besieged by industrialists and commercial men who wish to reserve space at the grounds. The Australian Trade Commissioner in the Union of South Africa has reserved a building to exhibit Australian products.

The second Royal Show will be held in Bulawayo in 1953. Generally speaking, the Royal Agricultural Society of Southern Rhodesia will operate on the same lines as the Royal Society in Britain and they will move from place to place for exhibitions.

# NEW BOOKS

## East African Agriculture

**Edited by J. K. Matheson and E. W. Bovill. Pp. xvi and 331. Illustrated. Geoffrey Cumberlege, Oxford University Press, 1950, 21s.**

In their preface the editors emphasise the need for a book descriptive of agriculculture in East Africa as a whole, especially as many Britons are turning to the country as a promising field for endeavour and a refuge from the difficult conditions at home. They have attempted to supply this, admitting that their aim has been limited and unambitious and that the real need is for a detailed and carefully documented textbook.

Within these limits they have produced a useful volume. As is to be expected, its emphasis is more particularly on the side of European agriculture, but it also includes a section on native African agriculture, as well as a number of short introductory chapters dealing with general aspects, such as soils and climate, soil erosion, land tenure, research and native labour conditions.

The book is the work of a large number of contributors, some of whom are engaged in actual farming, while others are members of the staffs of the various territorial Departments of Agriculture; a number of the chapters have been contributed by the editors themselves. In the circumstances it is not altogether surprising that the treatment varies considerably in different sections and the result is in places somewhat uneven.

One cannot avoid the conclusion that in compiling the book the editors may have tended to regard the future of agriculture in East Africa as dependent in the main on the further development of farming on European lines.

To the reviewer it has always seemed that, while the development of European farming has undoubtedly conferred great benefits and is capable of further expansion, the great problem with which Africa is faced is the devising and introduction of systems of native farming suited to the rapidly changing conditions, which will permit the two forms of agriculture to continue to exist and develop harmoniously side by side. They are really part of a single whole and interdependent to a large degree.

So far as European agriculture is concerned, the book gives an interesting and concise account of the history of its development and its present status in Kenya, Uganda and Tanganyika. The differences are wide; they are partly the product of the environments, but much more so of the different governmental policies which have been adopted. It is in Kenya, of course, where the greatest development of European farming has occurred, and the major parts of these sections naturally relate to conditions there.

Accounts are provided of 13 of the major crops grown in European areas, while 20 pages are devoted to the European livestock industry. Taken as a whole, they are well documented with statistics of production, while the inclusion of detailed estimates of the cost of growing the various products is a novel and interesting feature. It will no doubt be welcomed in many quarters, but one suspects that it may possibly hold the seeds of future controversy.

The sections dealing with native agriculture are by different hands and it might have been an advantage if they could have followed the same plan throughout, since it would have facilitated comparison of the situation in the different territories. In the section on Kenya, for example, Mr. A. W. Thompson has given excellent brief accounts of the circumstances in each province and it would have been valuable if this could have been done in the parallel cases in Uganda and Tanganyika.

In chapter VI Mr. Colin Maher has provided an admirable and well-balanced discussion of the more salient points of the soil erosion and soil conservation position, bringing out very clearly the difference between the position and outlook in the European settled areas and the native reserves. With his definition of the latter aspect as the African enigma one can unreservedly agree.

What appears to the reviewer to be an important lacuna in the work is the absence of any detailed account of the problems of animal diseases and their control and of the closely related question of pasture improvement. The part played in both European and native agriculture by animal husbandry is so important and the advances made and capable of being made in both directions are so outstanding that the omission seems regrettable. One hopes that it will be possible to rectify it in a subsequent edition.

However, apart from these criticisms, the book has many useful features and certainly fulfils the intentions of its editors in providing a useful introductory handbook on the subject. It is extremely well produced and contains 32 admirable photographs dealing with various aspects of East African agriculture, and five maps. There are also nine appendices, which include statistics of meteorological conditions, population, exports, as well as sections dealing with estate accounts, the feeding of the African labourer and weights and measures.

H. T.

## Minor Elements

**'Bibliography of the Literature of the Minor Elements and their Relation to Plant and Animal Nutrition.' Volume I. Compiled and published by the Chilean Nitrate Educational Bureau, New York, 4th edition, 1948.**

This is the fourth edition of the 'Bibliography of the Minor Trace Elements and their Relation to Plant and Animal Nutrition' compiled under the auspices of the Chilean Nitrate Educational Bureau. The first edition was published in 1935.

Interest in minor elements in agriculture expands continuously and to workers in this field this monumental compilation should be of inestimable value. It contains abstracts of all the main papers so far published in this field and deals with the 50 trace elements which have so far been found to play a part in plant nutrition.

The work has been done by reproducing the actual abstracts from various technical journals by photography and by offset lithography, thereby eliminating much of the enormous task of checking and proof reading.

The volume contains 988 pages of references, with a further 42 pages of indices and upwards of 7,000 abstracts.

H.T.


### To Authors and Readers

**The Editor and Publishers of WORLD CROPS will be glad to consider manuscripts of books submitted for publication. We already publish a number of books on technical subjects, all of which find a world sale and most call for regular reprints and new editions.**

**Books of a non-fictional type in any language by any publisher can be supplied by the Book Department of WORLD CROPS.**

## CORRESPONDENCE

# Horse v. Tractor

To The Editor,

Sir,

The leading article in the May issue of World Crops does a disservice to agriculture in championing the horse. The article speaks of the farm animal, but it is presumed that animals for draught purposes only are, in fact, under discussion. This clarification is not put forward in any spirit of pedantry but because it is essential to any proper discussion of the relative merits of mechanical or animal power.

Draught animals occupy land that could be used more profitably for other animals producing meat, milk or wool, and also more dung than draught animals. That is the great handicap of horses or any draught animals. They reduce the area from which the peoples of the world may be fed, and also, of course, the farmers' profit potential.

Home-grown food is not something for nothing. Even so, there is no fundamental reason why tractor fuel should not be home-grown. For example, experiments in distillation have proved conclusively that 30 tons of potatoes produce sufficient alcohol for 1,000 hours of tractor work, which is more than the average year's work for four horses.

The suggested compromise in using both tractors and horses shows lack of appreciation of the true economics in the use of power. Whichever form of power is used, the more fully it is profitably employed, the lower the cost per hour. It is generally agreed that tractors are superior for cultivation work. Therefore, the benefit of the tractor is reduced when horses are kept for other work.

Compaction of the soil by tractor is another complete fallacy. Assuming that a horse weighs 14 cwt. his pressure on the ground is just under 19 lb. per sq. in. when in work, since he is alternatively standing on two feet while moving. In contrast, a 21 cwt. tractor gives a pressure of approximately 10 lb. per sq. in. Anyone can test this by noting how much deeper a horse's hoofs sink into the ground than the wheels of a light tractor.

Labour is the biggest single item in food production costs and the tractor is the best means yet available to make that labour—which everyone agrees to be worthy of the highest possible wage—more productive. The output of a tractor driver is at least three to four times what it could be following a pair of horses.

Moreover, it is only by the proper use of mechanical power that full advantage can be taken of the many scientific advances such as ley farming, grass drying, fertilisers, pest control, and the like. These practices are being brought into use on land that was regarded as uncultivable in the days of the horse.

To sum up, mechanical power is the biggest single factor available today for reducing food production costs, the first step towards overcoming the world's present economic troubles. It provides the means for building up fertility and ensuring ample food within the price range of all, while permitting fair wages to the worker and more stable income and better living for the farmer.

Yours faithfully,

for Harry Ferguson, Limited,

A. B. Lees,

*Economic Research Manager.*

Note by the Editor

*We would point out that in speaking of animal traction we included in the article in question not only the horse which is predominant in this country but also oxen which are so widely used for tractive purposes overseas, but particularly in tropical countries.*

---

## Italy to Improve Somaliland Farms

The former Italian Somaliland has now been placed under Italian trusteeship, under UNO control, and the Ministero del Africa Italiano is making special arrangements for improving the agriculture of the country. Experts, some with many years' experience in Africa, have been sent to supervise work which is being principally directed towards banana cultivation, for which conditions in Somaliland are good.

## Water Conservation in Southern Rhodesia

Having a combined capacity of more than 750 million gal., 371 dams were constructed in the 70 Intensive Conservation Areas of Southern Rhodesia. So said the Minister of Finance in his budget speech, reviewing the work undertaken in the past year by the National Resources Board and Irrigation Department.

In all, the year's work resulted in the full protection of nearly 150,000 acres, and farmers had voluntarily agreed to protect all cultivated land by the end of the next planting season—an undertaking which the Minister believed to be unique to Southern Rhodesia.

The total of conservation works built in the Colony under supervision of the Department from 1946 to date, excluding minor works holding half to one million gal. each, is 2,316 dams and weirs of varying sizes, providing an aggregate storage of about 28,800,000 gal. of water, or an amount equal to nearly six times the capacity of the Mazoe Dam. The majority of these works have been constructed by private concerns with the advice of the Department.

---

## New Flour Mill for Mozambique

A campaign has been conducted for some time past by the Mozambique Agricultural Services for an expansion of the area under wheat in this Portuguese Colony so as to reduce grain imports and conserve foreign exchange. At present Mozambique imports 50 million escudos' worth of flour annually.

Encouraged by the results of the campaign and by certain facilities accorded by the authorities, a new company has been formed there for the establishment of a flour-milling and foodstuffs industry. Called ' Companhia Industrial da Matola,' the company has already started construction of flour milling facilities at Matola, near Lourenco Marques, which will be capable of turning out 22,000 tons of flour annually. In addition, it plans to construct at Matola a grain silo capable of storing and treating 10,000 tons of cereals annually. The silo will be 40 metres high, have 11 stories and is to be completed by the end of this year. The mill plant will have 16 double-roller mills, grain separators and lifts for transporting the grain.

Construction cost of the mill and silo is estimated at 18 million escudos, while an expenditure of 40 million escudos will be required for the total project.

# WORLD CROP REPORTS

### Hope for good tea crops in India and Pakistan

There was a distinct improvement in the quality of Indian tea harvested in 1949. As a result, India regained its position as the chief supplier of tea to the United States. In 1949 the United States imported 33.2 million lb. of tea from India and 31.7 million from Ceylon, compared with 1948 imports of 28.1 million lb. from India and 45.1 million from Ceylon.

Tea traders in India expect the 1950 tea production to exceed the 1949 output. Production in North-East India is expected to equal the record 1949 harvest of 475 million lb., and production in South India and Pakistan is expected to exceed the 1949 crops of 101 million lb. and (estimated) 45 million lb. respectively.

### Revised world cacao production estimates

World production of cacao beans in 1949-50 is now expected to total about 1,627 million lb., almost 4% higher than was forecast in December 1949 and just 2% below the 1948-49 output of 1,652 million lb., according to reports from U.S. Foreign Service officers. The pre-war (1935-39) production averaged about 1,579 million lb. of cacao beans annually.

Revised forecasts of cacao bean production in 1949-50 by continents are: 135 million lb. for North America, 441 million lb. for South America, 1,038 million lb. for Africa, and 13 million lb. for Asia and Oceania. This represents a substantial increase over the earlier forecast for South America and Africa and a slight decrease for North America. In comparison with the 1948-49 crop, the forecast for South America now is 52 million lb. higher. Africa, however, is expected to produce 86 million lb. less than in 1948-49.

### Brazilian coffee exports up

Brazil's exports of green coffee reached a record of 19.4 million bags in 1949, about 8% higher than the previous record of 17.9 million bags exported in 1941, according to the American Embassy in Rio de Janeiro. Brazil exported 17.5 million bags of coffee in 1948, 14.8 million bags in 1947, and an annual average of 15 million bags in the pre-war (1935-39) period.

Exports of coffee from Brazil to the United States in 1949 totalled 12.3 million bags, compared with 11.7 million bags in 1948 and an annual average of 8.3 million bags in pre-war years. Shipments of coffee from Brazil to Europe amounted to 5.2 million bags in 1949, compared with 3.9 million bags in 1948 and an annual pre-war average of 5.7 million bags. Brazil increased its exports of coffee to Africa from 0.3 million bags in 1948 to 0.4 million in 1949 and its shipments to Asia from 0.3 million bags in 1948 to 0.5 million in 1949.

As a result of over-production during the pre-war and war-time period, the Brazilian Government accumulated large supplies of coffee in storage. At the war's end, stocks held by Brazil's National Coffee Department totalled about 8 million bags. An additional supply was held by individuals and private Brazilian organisations. Since the war, these Brazilian stocks have been drawn on for export. The Brazilian Government stocks were exhausted by August 1949, and private stocks of coffee from the 1948 and earlier harvests are now practically exhausted.

### Forecast of smaller tobacco crop in Argentina

Argentina's 1949-50 production of leaf tobacco is forecast below the 1948-49 harvest, according to Dr. C. A. Boonstra, Agricultural Attache, American Embassy, Buenos Aires. Leaf imports during 1949 were 25% below the 1948 level. Stocks of leaf are reported to be extremely low and substantial imports are required if consumption is to be maintained.

Trade sources forecast the country's 1949-50 production of leaf tobacco at from 51,000,000 to 56,000,000 lb. This compares with the revised official estimate of 57,700,000 lb. in 1948-49 and 47,400,000 lb. in 1947-48. The decline forecast for 1949-50 is attributed to a lower yield per acre resulting from unfavourable weather during the growing season. As usual, most of the 1949-50 crop will consist of dark air-cured native types of leaf, but approximately 7,700,000 lb. of flue-cured and 1,100,000 lb. of burley are expected from the current crop.

### El Salvador sesame reduced

The 1949-50 El Salvador sesame crop, harvested in April, is estimated at 4,600 tons, or only about half of last year's crop. Approximately 3,300 to 3,600 tons should be available for export. Although local vegetable oil mills in recent years have consumed as much as 2,500 to 3,000 tons of sesame annually, this year it is expected that they will take only 1,000 to 1,300 tons. Since there is no satisfactory market for this year's cottonseed crop, which is especially good, crushers prefer to press cottonseed and export sesame seed. Exports of sesame during 1949 amounted to 6,908 tons, of which Trieste took 2,178 tons, the United States 1,294, and Costa Rica 1,291.

### Another huge maize crop expected in U.S.A.

World maize production for the crop year 1949-50 is expected to be 5,550,000,000 bushels, the second highest total on record, according to estimates by the U.S. Office of Foreign Agricultural Relations (a U.S. maize bushel is 56 lb.).

This figure is exceeded only by the total for the previous year of 5,990,000,000 bushels.

The world crop estimates are obtained by combining figures for maize harvested in the Northern Hemisphere in 1949 with preliminary forecasts for the Southern Hemisphere, where harvesting began in early 1950.

Favourable harvests in **North America** were due principally to the near-record crop in the United States. The U.S. crop alone accounts for about 60% of the world total. Per-acre yields in this country show an increase of about 55% of the pre-war period as a result of increasing proportions of high-yielding hybrid varieties of maize and improved agricultural practices.

The maize crop in **Europe**, estimated at 660,000,000 bushels, is smaller than the previous year, as well as below average. Yields in France, Spain and Portugal are reported to be considerably down, while those of the Balkan countries, other than Rumania, and for Italy are estimated at average or slightly better.

**Soviet** harvests are considerably below pre-war average, due to decreased planting and low yields, and in **Asia** production is slightly less than other years, due to low yields and slightly less planting.

### U.S. sugar beet forecast

The Crop Reporting Board of the United States Department of Agriculture states that a beet acreage this year of 980,000 is indicated which compares with 769,000 acres in 1949, or an increase of some 27%. This would be the largest acreage since 1942, when 1,048,000 acres were sown. It is observed that if the five-year average yields per sown acre are attained, a harvest of about 11,500,000 tons of roots would result from the above acreage, which compares with 10,168,000 tons last season. The Board points out that the actual area may turn out to be

higher or lower, depending as it does on weather and labour conditions, price changes, etc., and even the effect of the above report itself upon farmers' actions.

### *B.W.I. sugar estimates*

The West India Committee has received the following estimates of production for the year September-August 1949-50, which is compared with the previous year:

| | 1949-50 *Tons* | 1948-49 *Tons* |
|---|---|---|
| Barbados .. .. .. | *140,000 | *152,731 |
| Jamaica .. .. .. | 266,520 | 237,744 |
| Antigua .. .. .. | 27,000 | 18,263 |
| St. Kitts .. .. .. | 42,500 | 35,667 |
| Trinidad and Tobago .. | 152,000 | 159,135 |
| St. Lucia .. .. .. | 9,350 | 9,128 |
| St. Vincent .. .. .. | 2,300 | 2,084 |
| British Guiana .. .. | 194,624 | 184,690 |
| British Honduras .. .. | 1,600 | 2,108 |
| | 835,894 | 801,550 |
| of which, | | |
| Required for home consumption .. | 117,477 | |
| Available for export .. .. | 718,417 | |

*Including fancy molasses equal in terms of sugar to 20,000 tons.

### *Fewer Brazil nuts this year*

The 1950 preliminary forecast of Brazil nut production is 24,600 short tons, unshelled basis, compared with 35,200 tons in 1949 and 18,900 tons in 1948. The forecast is only 1% below the ten-year (1938-47) average of 24,800 tons but 72% above the five-year (1943-47) average of 14,300 tons. It is still somewhat early to obtain reliable estimates of the 1950 crop. There is the usual difference of opinion among the trade regarding it, with some forecasting a harvest about 3,000 tons smaller than given as the preliminary forecast at the beginning of this report.

### *World wine production*

Africa's and North and South America's wine production has steadily increased in the past 50 years, while it has reached a ceiling in Europe, French wine expert Prof. Aldebert told a wine conference held recently in Algiers. In 50 years, annual world production had been stepped up from 133 million hectolitres to 163 million hectolitres. Soviet Russia was producing 13 million hectolitres of good wines, notably champagne, each year, he added.

Prof. Aldebert pointed to the following trends in various countries: **Italy** could step up her exports in view of her reduced home consumption; **Spain** has expanded her wine area at the expense of grain; **Portugal's** production covers home and Colonial consumption; **Turkey** and **Greece** remain important producers of fresh and dried grapes; **North America** is reorganising her wine production, but does not appear as a dangerous threat to French exports there; **Brazil** and the **Argentine** do not produce good quality wines; **Chile** on the contrary has achieved some first-class results by using French vines.

### *Spanish tobacco production lower*

Spain's 1949 harvest of leaf tobacco is estimated at 6% below the 1948 crop, according to the American Embassy in Madrid. Imports of leaf during the first 11 months of 1949 were 2% below the corresponding period of 1948.

The country's 1949 production of leaf tobacco is tentatively estimated by the Spanish Ministry of Agriculture at 29.1 million lb. This compares with 30.9 million in 1948 and 28.6 million in 1947. The area planted to tobacco is unofficially estimated at approximately 22,000 acres in both 1949 and 1948 and about 18,200 acres in 1947. The decline in production and yield in 1949 resulted from a severe drought which prevailed during the spring and summer months. Usually more than 90% of the area planted to tobacco in Spain can be irrigated, but the drought resulted in a shortage of water for this purpose.

### *Smaller cashew crop in India*

The 1950 preliminary forecast of cashew production in India, including Goa, is 33,600 short tons unshelled basis, compared with 38,900 tons in 1949 and 51,000 tons in 1948. The forecast is 31% below the ten-year (1938-47) average of 48,700 tons and 28% below the five-year (1943-47) average of 46,600 tons. These figures relate to the nuts grown in India and Goa only and should not be confused with the output of shelled cashew nuts in India, which includes substantial quantities of African imports.

### *Venezuelan tobacco production rising*

Consumer demand for United States' type of blended cigarettes has resulted in a steady increase in production of flue-cured and burley leaf in Venezuela, according to the American Embassy in Caracas.

The country's production of flue-cured tobacco in 1949-50 is forecast at approximately 3.8 million lb. from about 5,400 acres, compared with 3 million lb. from 3,400 acres in 1948-49 and 2 million from approximately 2,300 acres in 1947-48. Burley production in 1949-50 is forecast at about 1.6 million from an estimated 2,600 acres. This compares with 1.3 million from about 1,560 acres in 1948-49 and 1 million from 1,230 acres in 1947-48. About 60% of Venezuela's tobacco acreage of approximately 8,175 acres was planted to flue-cured and burley types in 1948-49, compared to less than 20% prior to 1944-45.

### *World palm kernel exports*

World exports of palm kernels in 1949 are estimated at 811,438 tons, up 12% over 1948 and 2% over pre-war. Almost 95% of the total originated in Africa and the remainder in Indonesia and the Federation of Malaya.

Approximately 80% of the African kernel exports normally are supplied by Nigeria, the Belgian Congo, French West Africa and Sierra Leone. Nigeria alone, where practically all of the production is from wild palms, usually accounts for 50%.

In 1949, **Nigeria** exported 394,240 tons of palm kernels. This is the largest tonnage on record from this colony, exceeding both 1948 and the pre-war average by 7%. Total exports of kernels—as of oil—went to the United Kingdom.

The **Belgian Congo** reported exports of 88,220 tons of kernels in 1949, 4% less than in the previous year and 6% less than the 1935-39 average. The major portion of the 1949 shipments went to Belgium and Germany.

About 95,000 tons of kernels are estimated to have been exported from **French West Africa** the past year, or about 35% more than in 1948. Shipments from **Sierra Leone** were reported at 84,000 tons, representing a 13% increase over 1948 and a very slight (less than 1%) increase over the 1935-39 average. It is believed that the quantity of palm kernels available for export from this colony eventually can be increased to 112,000 tons annually; post-war yearly increases indicate that this goal may well be attained if the present high price can be maintained.

Palm kernel shipments from **Angola** in 1949 amounted to 12,800 tons, 30% more than in 1948 and 92% more than pre-war. The **remaining African exporting countries** shipped about 95,800 tons in 1949, a slight increase over 1948 but somewhat less than pre-war.

**Indonesian** palm recovery brought about significant expansion in kernel as well as oil exports. Recorded shipments for 1949 amounted to 31,585 tons, an increase of almost 160% over 1948. Pre-war exports averaged over 44,000. **The Federation of Malaya** exported 9,793 tons of kernels in 1949, or 35% more than in the previous year and 20% over pre-war. (*From Foreign Crops and Markets.*)